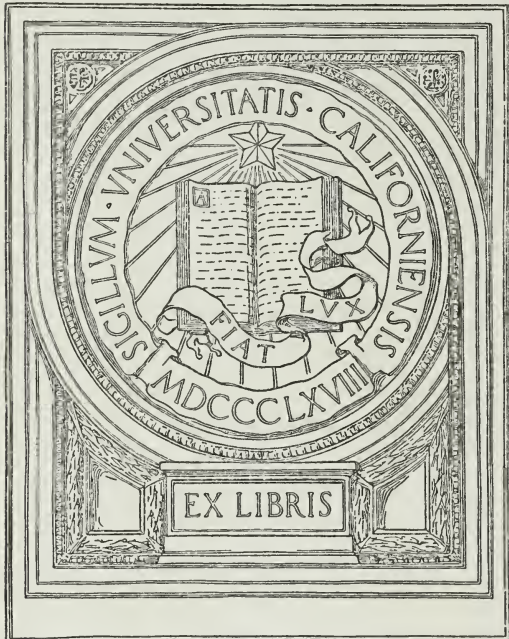




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# PULSATING EXOPHTHALMOS

*ITS ETIOLOGY, SYMPTOMATOLOGY, PATHOGENESIS, AND  
TREATMENT—BEING AN ESSAY BASED UPON AN ANALY-  
SIS OF SIXTY-NINE CASE HISTORIES OF THIS AFFECTION*

BY

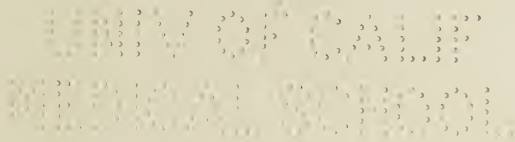
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## PREFACE.

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THIS essay is an elaboration of a paper read before the College of Physicians of Philadelphia, November 6, 1907, and presents in greater detail than it was possible to incorporate in the original communication the statistical data and the tabulation of the case histories upon which it was founded. The object of the essay is to compare the therapeutic measures, surgical and otherwise, which have been employed in the treatment of the cases which are analyzed, and to endeavor to determine from these analyses those surgical procedures which seem likely to prove of the greatest advantage in the control of the symptoms of pulsating exophthalmos. In addition to a review of the etiology, symptomatology, and pathogenesis of this affection, particular consideration has been accorded to the orbital operations which have been performed for its relief, and to which Professor Sattler's comparatively recent paper on this subject has called renewed attention. Cases of pulsating exophthalmos published later than July, 1907, are not included in the tables.

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## PULSATING EXOPHTHALMOS.

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From 1805, when Travers reported the first case of pulsating exophthalmos to which reference is usually made, until July, 1907, 313 cases of this affection have been placed on record, and a number of analyses of the literature have been prepared, beginning with Sattler's<sup>1</sup> elaborate collection, in which 106 cases are classified, based upon the records to the middle of 1880.<sup>2</sup>

Since that date several papers have been published containing extensive bibliographies, for example, those by W. Adams Frost,<sup>3</sup> Koehler,<sup>4</sup> Nieden,<sup>5</sup> Le Fort,<sup>6</sup> de Schweinitz,<sup>7</sup> Slomann,<sup>8</sup> Keller,<sup>9</sup> Werner,<sup>10</sup> Rascalou,<sup>11</sup> Reuchlin,<sup>12</sup> Houillon,<sup>13</sup> and Lagrange.<sup>14</sup>

<sup>1</sup> Graefe und Saemisch: Handbuch der gesammten Augenheilkunde, Bd. vi, 1880, p. 745.

<sup>2</sup> Prior to this date Rivington had tabulated a number of these cases in his well-known article published in the *Medico-Chirurg. Soc. Trans.*, vol. lviii, 1875.

<sup>3</sup> *Trans. of the Ophthal. Soc. U. K.*, 1883, iii, p. 15.

<sup>4</sup> *Deutsche Militärische Zeitschr.*, 1886.

<sup>5</sup> *Archiv f. Augenheilk.*, 1886-87, xvii, pp. 285-287.

<sup>6</sup> *Revue de Chirurg.*, 1890, x, p. 481.

<sup>7</sup> *International Medical Magazine*, February, 1895.

<sup>8</sup> *Jahresbericht f. Ophthal.*, 1898.

<sup>9</sup> *Beiträge zur Casuistik des Exophthalmus Pulsans*, Inaug.-Dissert., Zurich, 1898.

<sup>10</sup> *Zur Casuistik des pulsierenden Exophthalmus*, Inaug.-Dissert., Tübingen, 1898.

<sup>11</sup> *De la Compression et de la Ligature de la Carotide Primitive dans le Traitement de l'Exophthalmus Pulsatile*, Paris, 1901.

<sup>12</sup> *Zur Casuistik des doppelseitigen pulsierenden Exophthalmus*, Inaug.-Dissert., Tübingen, 1902.

<sup>13</sup> *Considerations á propos de deux cas d'Exophthalmus Pulsatile*, Thèse, Nancy, 1903.

<sup>14</sup> *Traité Tumeur de l'Oeil de l'Orbit et des Annexes*, vol. ii, pp. 261-315.

The object of the present essay is: (1) To analyze those cases—69 in number—not previously recorded in the tabular statements already referred to; (2) to elaborate and compare the therapeutic measures, surgical and otherwise, which have been employed in their treatment; and (3) to endeavor to determine from these analyses those surgical procedures which seem likely to prove of the greatest advantage in the control of the symptoms of this disease.

To follow the contention of Keller, the term “pulsating exophthalmos” should be strictly limited to that disease in which a communication of the internal carotid with the cavernous sinus has been demonstrated, or is reasonably certain.

It must be remembered, however, that although the most frequent intracranial cause of this disease depends upon the condition just described, in a certain number of cases aneurysm of the internal carotid and aneurysm of the ophthalmic artery, as, indeed, Keller himself points out, are interpreted by the cardinal symptoms of this affection—exophthalmos, pulsation, and bruit. So, too, tumors of the brain which have broken into the orbit, as well as tumors of the orbit itself, or protruding into it from neighboring sinuses, can cause symptoms which are analogous to those furnished by typical pulsating exophthalmos.

In early days pulsating exophthalmos, sometimes called “aneurysmal proptosis,” or “vascular protrusion,” was attributed solely to aneurysm of the orbit, although surgeons were not quite sure whether the lesion was a true aneurysm, an aneurysm by anastomosis, or aneurysmal dilatation of the ophthalmic artery in its whole course. Nélaton and Rivington first

satisfactorily demonstrated that exophthalmos, pulsation, and bruit may be due to an extraorbital aneurysm of the ophthalmic artery, to an aneurysm of the internal carotid, and to an aneurysmal varix involving the internal carotid and cavernous sinus, and, as we know, the last-named lesion, namely, arteriovenous communication, is the one most frequently responsible for these phenomena, and the one which Keller insists should alone be held responsible for them, in so far as the intracranial cases are concerned.

The accompanying tables, which for convenience also contain some instances of this disease reported in 1901 and 1902 already referred to by Houillon, include 80 cases. Of these, 11 may be regarded as doubtful or atypical. They are not utilized in the analyses which follow.

The remaining cases, 69 in number, are classified into:

Traumatic,.....	54	
Idiopathic or spontaneous, .....	13	
Tumor,.....	1	(44) <sup>1</sup>
Cause not stated,.....	1	(62)

#### ETIOLOGY.

Pulsating exophthalmos most frequently manifests itself as a unilateral condition, although in a certain number of cases the fellow-eye subsequently is implicated. In the 69 cases directly under consideration, both eyes were affected in 7, the right eye in 31, the left in 26, while in 5 cases it is not stated which eye was involved.

*Traumatic Cases.*—Sixty-eight and three-tenths per cent. of the total number of cases thus far reported have been of traumatic origin. In the present series

<sup>1</sup> Bracketed numbers refer to case numbers of the tables.

54 cases belong to this group, 31 males, 16 females, and 7 with the sex not designated.

Naturally the male sex predominates in this relationship. Thus, among 214 cases, 147 were males (68.6 per cent.), 53 were females, and in 14 the sex was not noted.

Of the 54 traumatic cases in our tables, the right eye was involved in 25, and the left in 21; in 5 the exophthalmos was bilateral, and in 3 the affected eye was not designated. Adding these to the cases cited by Sattler, Keller, and Reuchlin the result is as follows: right eye in 82, left eye in 87, bilateral in 31, and not stated in 14.

The average age at which the affection developed among the 44 cases in which the year of life is given is 30.6 years. By referring to Table I it will be seen that the greatest number of cases occurred in the third decade of life. The youngest case was four years (43), while the oldest was fifty-eight years of age (45 and 46).

TABLE I.—TRAUMATIC CASES.

AGES.	MALE.	FEMALE.	SEX NOT STATED.
1 to 10 years.....	3	3	1
11 to 20 ".....	3	2	0
21 to 30 ".....	7	4	1
31 to 40 ".....	5	0	0
41 to 50 ".....	6	3	0
51 to 60 ".....	2	4	0
Age not stated.....	5	0	5
Average age of the 44 cases in which the age is stated = 30.6 years.	31	16	7

Youngest case = 4 years (Usher).

Oldest case = 58 years (Ridley, Burghard and Pritchard).

Pulsating exophthalmos may be caused by direct or by indirect trauma. To the former class belong those



cases produced by gunshot or penetrating wounds, injuries from knitting-needles, umbrella ribs, and similar articles; to the latter class belong by far the larger number of cases, namely, those due to blows and falls, frequently associated with basal fracture. Among the traumatic cases in the present series the type of trauma is represented in the following classification:

Falls,.....	20
Blows,.....	18
Blow or fall,.....	3
Gunshot wounds,.....	6
Punctured or penetrating wounds,.....	7

*Idiopathic or Spontaneous Cases.*—Seventy, or 22.3 per cent., of the 313 cases reported to the middle of 1907 have been of spontaneous origin. Women are more frequent in this class than men. Thus, 17 were males, 49 were females (70 per cent.), and in 4 the sex is not stated. As in the traumatic cases, the left eye has been affected a few times more than the right.

Right eye,.....	26
Left eye,.....	35
Bilateral,.....	4
Not stated,.....	5

Included in the above cases are 13 occurring in the present series, among which is Pröbsting's (29) case history of a patient who was an epileptic, and who, therefore, was naturally predisposed to trauma. The record, however, contains no definite statement in regard to an injury to which the pulsating exophthalmos could be attributed.

Five of these 13 patients were males and 8 females. The right eye was affected in 4, the left in 5; two were bilateral and the involved eye is not recorded in 2.

The average age at which the affection developed among the 11 cases in which the year of life is given, is 42.7 years. By referring to Table II, it will be seen that the greatest number of these cases, one male and three females, occurred in the fourth decade of life. Hence the average time of onset is approximately one decade later in life than in the traumatic cases. The youngest patient in this series was sixteen months (66) and the oldest patient eighty years (73).

To the best of our knowledge, the oldest patient among the 313 cases so far reported was eighty-one years (62).

TABLE II.—SPONTANEOUS CASES.

AGES.	MALE.	FEMALE.	SEX NOT STATED.
1 to 10 years.....	1	0	0
11 to 20 ".....	0	0	0
21 to 30 ".....	0	2	0
31 to 40 ".....	1	3	0
41 to 50 ".....	0	0	0
51 to 60 ".....	2	0	0
61 to 70 ".....	0	1	0
71 to 80 ".....	0	1	0
Age not stated.....	1	1	0
Average age of 11 cases in which age is stated = 42.7 years.	5	8	0
Average age without child 1.33 years old = 46.8 years.			

Youngest case = 16 months (de Bruin).

Oldest case = 81 years (Cantonnet and Cerise).

Among the 8 women in this series of spontaneously developed cases it is interesting to note that two were pregnant (10 and 65). Sattler speaks of 7 similar cases among the 23 women he included in his idiopathic group. Keller refers to 3 among 12 women, and Reuchlin mentions 2 among 6. Hence among these

49 women, pregnancy and its associated conditions have been an etiologic factor in 14 cases, or 28.5 per cent., or in 4.4 per cent. of the total number of cases thus far recorded.

Among the remaining 11 cases in the present series 2 patients (7 and 9) developed pulsating exophthalmos after vomiting, one during an attack of malaria, and the other during the menstrual period. Coughing was apparently the exciting cause in one case (6), straining at stool in another (17), and straining efforts while washing windows in a third (32).

In Usher's patient (42) the first symptom was noted upon arising in the morning, and no history of syphilis, gout, rheumatism, or ocular affection could be elicited. Pröbsting's patient (29) is the epileptic already referred to. In three case histories (1, 72, and 73) there is no mention of the probable exciting cause.

In the case of the sixteen-month-old infant reported by de Bruin (66) there was no history of trauma preceding the onset of the disease, but the affection followed whooping-cough.

Aubry has reported a case following typhoid; Scaramuzza one following intermittent fever with congestion of the brain; Noyes one during convalescence after a fever and De Vincentiis refers to one which developed after an attack of facial erysipelas. The last case attracts attention to the patient whose history is reported by Belt (6), and who developed erysipelas six weeks after the onset of pulsating exophthalmos.

While the most frequent direct cause of pulsating exophthalmos is rupture of the internal carotid in the cavernous sinus, a number of subjects of this affection

belonging to the idiopathic cases had some pathologic change in the vascular system which may have acted as a predisposing cause.

Zur Mühlen, in discussing the development of pulsating exophthalmos in children, refers to the observations of Hoffman, who attributes the predisposition of the basal vessels to aneurysmal formations, to the thinness of their walls and the slight development of their muscular and elastic elements in childhood.

*Tumors.*—As already has been pointed out, tumors of the brain which have broken into the orbit, as well as tumors of the orbit itself, or protruding into it from neighboring sinuses, may cause symptoms which are analogous to those furnished by typical pulsating exophthalmos.

Van Duyse's case (44), occurring in a man with sarcoma of ethmoidal origin, illustrates the difficulties sometimes attending the diagnosis of this condition, for the patient presented the three cardinal symptoms of pulsating exophthalmos, and the affection was at first attributed to an aneurysm of the ophthalmic artery. Certain congenital defects of the orbit may likewise contribute analogous symptoms, as in Erklentz's case (14). Maynard and Rogers (54) also report a unique and interesting case, in which the ocular symptoms were dependent upon a dilatation and dropsy of the optic nerve produced by internal hydrocephalus.

Keller and Reuchlin among 138 cases of pulsating exophthalmos refer to 12 caused by tumors.

#### SYMPTOMS.

Exophthalmos, pulsation, and bruit are the most prominent features of the affection to which the name

“pulsating exophthalmos” is usually applied, although the venous masses or tumors frequently evident at the inner angle of the orbit have in recent years attracted more attention than formerly, owing to the success which ligation of the orbital veins has achieved in the treatment of this condition and to which especial attention will be directed in subsequent pages of this essay.

The exophthalmos is usually quite pronounced, and often develops to such an excessive degree that the lids are no longer able to cover the globe, thus exposing the cornea to injuries which frequently result in ulceration of this structure.

The proptosis may be straight forward or eccentric, the most frequent position being down and out. Thus it was straight forward in Belt's (6) and Bull's (25) patient; in Braunschweig's (57) patient the globe was pushed toward the outer orbital wall; Pincus (79) describes the eye as being forward and slightly down and in; and Hansell (56), Cushing (74), Van Duyse (44), Mariani (17), Collins (31), Lewis (75), Plenk (61), and Schwalbach (64), as down and out. Pressure upon the eyeball, as a rule, reduces the exophthalmos, although not always, even among those cases where the symptoms have been produced by lesions other than tumors. Compression of this character is usually painless, and the globe promptly returns to its former position upon the removal of the pressure. Punzo (59), however, who was himself the subject of this affection, states that such pressure was painful and produced some interference with the cardiac action.

*Pulsation.*—Pulsation either of the globe or in the adjacent orbital structures can be demonstrated by careful examination in fully 90 per cent. of the cases,

although it is the least essential of the three cardinal symptoms in establishing a diagnosis.

Keller refers to but 5 cases in his series in which this condition was absent. In our own tabulation, if 12 cases with inadequate data are excluded, only 6 failed to have this symptom (1, 35, 50, 52, 66, and probably 32).

In some subjects of this affection in the present series (25, 30, 41, 57, etc.) pulsation was both visible and palpable; in others (3, 12, 22, 59, 60, etc.) it was detected only by the superimposed fingers, while in a few instances, as in case 79, backward pressure of the globe was necessary to elicit it. Even if the pulsation is visible, pressure usually renders it more pronounced. Pulsation of the globe itself may be absent and only present over the much distended veins adjacent to the eyeball, as in cases 23, 45, and 47. The pulse curve of these veins may be similar to that of the carotid curve.

*Bruit.*—The bruit, one of the characteristic and most interesting factors of the symptom-complex of this condition, has not always received the attention to which it is entitled.

The *subjective* bruit is usually one of the first symptoms noted, and often proves most distressing to the patient, especially if it is of sufficient intensity to prevent sleep. It is variously described as a humming, buzzing, puffing, and roaring sound; in some instances it has been likened to escaping steam from an exhaust valve, a steam-engine, or blow of a forge; again, it may have a metallic character like the ring of an anvil, or "a bell just done ringing," as described by Cushing's patient. Sometimes it is localized in one ear, or is more pronounced on one side of the head than the other, and

then corresponds to the side of the affected eye, as in cases 11 and 60.

The *objective* bruit may manifest itself during systole or be a continuous murmur, to which in the majority of cases is added a systolic accentuation. Thus, Usher (42) describes it as a loud blowing murmur, synchronous with the pulse and widely conducted by the bones of the skull. Sobernheim (30) states that a loud metallic murmur synchronous with systole was heard over the whole skull, but especially on the left side and in the neck. In the patient, whose case is reported by Cantonnet and Cerise (73), a continuous bruit without accentuation was evident in the periorbital region. Mariani (17), referring to the character of the objective bruit, describes, over the lid and the swelling at the upper and inner angle of orbit, as well as over the frontal and temporal regions of both sides, a soft continuous murmur with systolic accentuation. Pincus (79) states that over the eye, temple, and other portions of the skull a continuous roar, interrupted by a loud systolic blow, could be heard, while now and then a distinct "bruit de piaulement" was noticeable. These citations sufficiently illustrate the variability in the character and intensity of the murmur.

In 60 case histories of the present series which make reference to the bruit it was systolic in 21, continuous in 3, and continuous with systolic accentuation in 5. In 31 cases it is not described, although a bruit is stated to have been present.

The area over which the bruit could be heard was "local," that is, it was confined to the eye, or the eye and temple, in 18 of these cases; and "general," that is, heard over the whole skull or the greater por-

tion of it, in 24 instances. In two cases the intensity of the bruit was excessive; thus, Karplus (1) states that it could be heard several centimeters from the head, while in Ballin's patient (63) it was audible eight inches from the skull.

The *bruit de piaulement*, which manifests itself as a rather musical murmur with a high whistling tone, is demonstrable in some cases, and is doubtless overlooked in other instances, probably on account of its intermittent character. Pincus (79) reports it as present in his patient, and there is a possibility of its existence in the patient described in case history 34. If the above cases are included with 11 others previously reported, in only 5.8 per cent. of the last 207 cases of pulsating exophthalmos has this interesting sign been observed, or at least noted, a symptom which Rivington and Sattler believe to be highly significant of arteriovenous communication.

*Venous Masses.*—In a large number of cases the stasis and engorgement existing in the ophthalmic veins give rise to the formations of venous swellings or tumors adjacent to the globe. The most frequent seat of these masses is in the upper and inner portion of the orbit below the arch, although they may occur in other sites about the orbit. These masses are round, oval, or fusiform in shape, almost invariably painless, soft and compressible, and over them can usually be detected a pulsation and thrill.

Among the cases in the present series 19, or 27.5 per cent. (4, 16, 17, 18, 25, 28, 30, 36, 44, 45, 46, 47, 50, 53, 61, 64, 74, 76, 80), developed marked venous distentions about the eye, while in cases 11, 23, 56, 57, 59, and 69 there was also observed enlargement of the



veins, but probably not to a degree to warrant their inclusion in this list. Among the last 207 cases of pulsating exophthalmos recorded, these venous masses have been present in 28.5 per cent. of them. At times this venous distention is quite extensive, as is illustrated by Weisinger's patient (36), in whom an enormous venous ectasia appeared on both sides under the eyebrows and on the left frontal region, while tortuous vessels ran toward the vertex and temporal regions.

One of Sattler's patients (47) developed masses above and below the eye, and Zur Mühlen (50) describes soft masses of distended veins at the upper and outer portions of the orbit, with enlarged veins running from the outer angle and disappearing in the hair; the venous distention at the inner angle was not so pronounced. Cushing (74) mentions venous dilatations at the outer and inner angle, and states that the supraorbital vein was the size of the index-finger. Plenk (61) refers to a venous mass directly above the globe, below the orbital margin, with dilated veins running to the nasal and temporal sides. In two patients described by Kennedy (53) and Lambert (18) venous masses were evident at the inner canthus between the globe and lids, in addition to venous dilatations elsewhere.

While the most frequent seat of this venous ectasia is the upper portion of the orbit, in a few instances the lower portion may be the site of its development. In the patients whose cases are reported by Van Duyse (44) and Burghard and Pritchard (46) a pulsating mass developed below the inner angle, and Sattler (47), in addition to masses above, found an elongated swelling along the lower orbital margin over which a murmur and thrill could be demonstrated, but pul-

sation, evident over the superior ectasia, was wanting. In this connection it should be remembered that the inferior ophthalmic vein is considerably smaller than the superior ophthalmic vein and after receiving the inferior muscle-branches and inferior venæ vorticosæ, either joins the superior ophthalmic vein or empties directly into the cavernous sinus. On the other hand, the superior ophthalmic vein receives the ethmoidal, lachrymal, and upper muscular branches, as well as the ciliary veins, the upper venæ vorticosæ, and at times the central vein of the retina.

*Lids and Conjunctiva.*—In the majority of cases the lids are red, swollen, and more or less edematous; dilated and tortuous veins are frequent (56, 69, etc.), and at times pulsation can be detected in these vessels, as, for example, in Plenk's case (61). These conditions are usually much less marked in the lower lid, although in some instances ectropion develops, as in cases 17 and 31. The upper lid frequently droops, either from paralysis or on account of local conditions, and a marked accessory action of the frontalis is often noticeable.

The conjunctiva may be chemosed and injected. If the chemosis is excessive, the ectropion, previously referred to, may develop. In Belt's case (6) this chemosis was so marked that scarification and excision of a portion of the protruding conjunctiva was deemed advisable. Tortuous and dilated conjunctival vessels are usually present.

*Vision.*—Vision may remain intact throughout the course of the affection, as was the case in 13 (11 cases) of the 57 eyes, the visual acuteness of which is recorded in the present series. More frequently it is impaired, and often absolute blindness results. The

varying degrees of visual impairment associated with this affection can be ascertained by referring to Table III, in which it will be seen that 10 eyes became blind, 5 eyes suffered a reduction of vision to light perception or to counting of fingers, and 29 eyes had some visual defect. Disturbances of sight may develop gradually in the form of a progressive optic nerve atrophy, or may be abrupt in onset, and depend upon serious intraocular lesions or direct injury to the optic nerve.

Among the 10 blind eyes in the table there is one case of a bilateral blindness reported by Mariani (17) in which the left eye became blind early, while in the right the blindness developed during the night some two months later, and was attributed to pressure upon the optic nerve caused by an acute dilatation of the cavernous sinus. In Siegrist's case (12) the blindness was the result of an embolism of the central artery of the retina.

These 10 eyes (9 cases), while they represent the ocular mortality among the eyes affected by pulsating exophthalmos, do not represent the actual ocular mortality among the patients so affected, for in 2 cases (44 and 79) the fellow and non-pulsating eye became blind, while in Wiemuth's case (19) the non-pulsating eye on the side of the injury—which was a gunshot wound—early developed a neuro-paralytic keratitis, and was enucleated. The pulsating exophthalmos which developed in the other eye resulted in blindness.

By reference to the cases of pulsating exophthalmos previously reported it will be seen that there are 23 cases of blindness in Sattler's tabulation, 26 in Keller's list, and 6<sup>1</sup> in Reuchlin's tables. If these cases are in-

<sup>1</sup> Four cases in the text.

cluded with the present series it is evident that at least 64 cases, or 20.4 per cent. of the total number, have terminated in blindness. This result does not include those cases in which the vision was reduced to light perception or the counting of fingers. Judging from our own investigations and those of previous observers, not more than 11.1 per cent. of the subjects of pulsating exophthalmos have retained normal vision.<sup>1</sup>

TABLE III.—LAST RECORDED VISION.

	NUMBER OF EYES.	TRAUM.	SPONT.	TUMOR.	CAUSE NOT STATED.
Blind.....	10	7	3	0	0
Light perception or counting fingers.....	5	5	0	0	0
Greater reduction of vision than $\frac{1}{2}$ .....	11	9	2	0	0
Less reduction of vision than $\frac{1}{2}$ .....	18	14	3	1	0
Normal vision.....	13	11	2	0	0
Vision not stated.....	19	13	5	0	1
	76	59	15	1	1

The various conditions which have contributed to loss or depreciation of vision include optic nerve atrophy; corneal lesions, such as neuro-paralytic keratitis and corneal ulcer, which in turn may lead to a panophthalmitis; iridocyclitis; glaucoma; intraocular hemorrhage and embolism of the central artery of the retina. Weisbach<sup>2</sup> refers to 5 cases occurring in Sattler's and Keller's tabulations in which the globe became atrophic. In Reuchlin's list there is no reference to this condition, while it occurred in one case (6) in the present series.

<sup>1</sup> Percentage based upon total number of cases and not upon the number in which vision was stated.

<sup>2</sup> Inaug.-Dissert. Pathologisch-anatom. Untersuchung eines infolge von Exoph. pulsans erblindeten Auges, 1901.

Treatment may be followed by a notable improvement in sight, as was the case with Thierry's patient (27), whose vision improved from  $\frac{1}{10}$  to  $\frac{5}{7.5}$ . In Gifford's case (80) the patient's vision was reduced to fingers at 1 or 2 feet and rose to  $\frac{2}{30}$  six months after operation. In cases 9, 30, 32, 33, 42, 57, and 69 some improvement in visual acuteness is recorded.

*Cornea.*—This structure was involved in 16 cases of the present series; in 4 (49, 51, 57, and 62) neuro-paralytic keratitis developed, in 5 (6, 60, 77, 78, 80) ulceration of the cornea, while in the others variously described lesions as striate keratitis (46), which appeared two days after ligation of the carotid, vascularization (4), infiltration (13), "slight opacity" (17), and "haziness" (41, 43, and 53) are noted. In two cases the cornea of the eye which did not exhibit pulsating ophthalmos was affected; in one (19) in the form of a neuro-paralytic keratitis requiring enucleation and in the other (79) by a serpiginous ulcer. These affections of the cornea develop as the result of disturbances of the nutrition of this membrane, and also depend upon its exposure because of excessive exophthalmos and imperfect closure of the lids.

*Iris.*—This structure is described as hyperemic in some instances (5, 30, etc.) and in one case (13) iritis was present. Posterior synechiæ, the result of a chronic iritis, were found in one patient.

*Pupils.*—These may be normal, or contracted and fixed, as in case 36; but in the majority of instances they will be found dilated and either sluggish or reactionless. In the case histories of the present series they are described as dilated in slightly over one-half

of them. In Zur Mühlen's interesting case (50) the hemianopic pupillary reaction was present.

In about 4 per cent. of the cases lenticular changes were evident; for example, in cases 30 and 37, but not necessarily caused by the pulsating exophthalmos. Keller cites 5 instances in his report of 102 cases. Still less frequently changes in the vitreous are recorded (5), although this structure may be temporarily affected after ligation of the carotid, as in Cushing's case (74).

*Fundus.*—The fundus veins will be found in the majority of instances to participate in the venous stasis which forms such a notable feature of this affection. Thus, in 34 cases of the present series in which the condition of the retinal veins is described, they are referred to as dilated, engorged, or full in all but three instances. In two of these they are reported as contracted, and in one they are described as pulsating.

In case 53 the contracted veins were associated with optic nerve atrophy, but in case 34, with a normal nerve-head. Pulsation of the retinal veins was present in 7 cases.<sup>1</sup> The arteries are most frequently found contracted, but may be normal, and in a few instances dilated, as in cases 32 and 74. These vessels may also show pulsation (72).

Hansell (56) reports that at the time of carotid ligation the retinal arteries became invisible, and this phenomenon was repeated at the second ligation.

<sup>1</sup> Knapp (5) reports a peculiar beaded condition of the retinal veins; nearly all the larger venous trunks presenting one or more of these spherical distentions. Where these were multiple, the vessels presented an appearance not unlike a string of beads. In a case already reported by one of us (Dr. de Schweinitz) this great distention, not only of the retinal vessels with unequal constrictions, but also of the exterior ocular vessels, particularly of the conjunctiva, was a marked feature of the process.

Cushing (74) likewise refers to this appearance after ligation. In his case it was followed by clouding of the media, so that the fundus became invisible and the patient stated that vision had entirely disappeared. This condition persisted about twenty minutes, and when the fundus details could again be noted the arteries were seen to pulsate.

Retinal hemorrhages were observed in 5 cases of the present series (5, 11, 25, 35, 56), while in 1 case (77) they were found by microscopic examination. In Mariani's case (17) the fundus showed a high degree of anemia. Neff (35) reports 'macular changes which developed in the course of the affection, while in Siegrist's case (12) a stoppage of the central retinal artery occurred after ligation of the carotid, which was attributed to an ascending thrombosis of the internal carotid.

The *disc* frequently reveals some pathologic change, as might be expected from the underlying etiologic conditions. Thus, among 32 cases containing a reference to the optic papilla, in 10, or 31.2 per cent. of them, it gave ophthalmoscopic evidence of some degree of atrophy; while in Jack's and Verhoeff's case (77) it was found to be atrophic by microscopic examination, the fundus not being visible while the patient was under observation. In 4 others it was pale or pallid. If these last 5 cases are included, the nerve was probably undergoing some degenerative process in 46.8 per cent. of the cases in which reference to the papilla is made, or in 21.7 per cent. of the total number of cases in this series.

"Choked disc" is reported twice (22 and 44), and "optic neuritis" once (69). In a number of records the disc is described as hyperemic, congested, or as having hazy and blurred edges.

Among 44 cases in which fundus conditions are described, the eye-ground was regarded as normal in only 2 of them (29 and 31). Glaucoma is reported once (13).

*Ocular Muscles.*—Naturally, disturbances of ocular motility are prominent symptoms in pulsating exophthalmos. In 5 eyes of the present series there was complete external ophthalmoplegia, and in 6 complete immobility of the globe. From the descriptions it is not possible to state with accuracy whether this immobility depended upon paralysis of the external ocular muscles or upon surrounding orbital conditions. The movements of 7 of the eyes are described as “nearly fixed” or “impaired in all directions” or by some similar phrase denoting “general limitation” of motion. Exclusive of a complete ophthalmoplegia, which would necessarily imply involvement of the third or oculomotor nerve, a special involvement of this nerve is recorded in 7 instances. By far the most frequent muscle to be involved is the external rectus, and, therefore, the abducens nerve, and a paresis or paralysis of the abducens is noted in the descriptions of 19 eyes (17 cases), and in 3 of the cases it was bilateral. There is no accurate differentiation of which muscle was affected in 6 eyes, but there was diplopia, and in 3 of these cases the character of the diplopia was such that the third or oculomotor nerve must have been paralyzed. To describe the muscular anomalies of 3 eyes (2 cases) “strabismus” is the term employed; in one case it was an alternating strabismus. In 11 eyes (10 cases)<sup>1</sup>

<sup>1</sup> While these eleven eyes belong to ten cases, in two of these cases in which the other eye showed muscular impairment, the exophthalmos was bilateral; therefore only eight instead of ten cases were exempt. Four eyes showed involvement of both the third and the sixth nerves.



the ocular movements were full and free, and, therefore, it may be assumed that there was no involvement of the muscles, or of the nerves supplying the muscles; while in the records of 16 eyes or cases there is no statement to indicate whether or not there was an implication of any of the external ocular muscles.

It is, therefore, evident that 49 eyes (45 cases) of the 69 cases of this series gave evidence of some affection of the extraocular muscles, while 11 eyes escaped in so far as anomalies of the ocular muscles are concerned. If, referring to these conditions, the statistics of these 69 cases are included with those of the preceding 138 cases, there was immobility of the globe, dependent upon paralysis of the ocular muscles or surrounding orbital conditions in 16.9 per cent.; limitation of movements in all directions in 11.5 per cent.; and involvement of the abducens nerve in 22.7 per cent.<sup>1</sup> Reuchlin (36 cases) reports implication of the oculomotor nerve in 4 cases, which, combined with the present series, would make 11, or 10.4 per cent.

In about 40 per cent. of the 45 cases in the present series with some impairment in the ocular movements, an improvement occurred subsequent to treatment, and this was especially marked in cases 3, 27, 34, 42, 59, 60, and 80. A marked improvement was noted in a number of cases in the fifth or sixth week following operative procedures. Usually the abducens paralysis is the most persistent of the exterior ocular muscle palsies.

*Other Disturbances of Special Sense and Mobility.*—In 9 cases (17, 21, 27, 35, 41, 44, 50, 51, 60) hearing was impaired or lost, although such defect does not neces-

<sup>1</sup> These percentages are based on the total number of cases.

sarily mean an involvement of the auditory nerve. Impairment of taste and smell is reported once each (17 and 44 respectively). Involvement of the first branch of the fifth nerve—in one instance bilateral (61), although the exophthalmos was unilateral—is definitely recorded five times (49, 51, 57, 61, 62), while in two instances (30, 79) the inference that this nerve was affected is a fair one, and in one case both the first and second portions were implicated. In still another (19), neuro-paralytic keratitis developed on the side of the injury, necessitating enucleation, and six months later pulsating exophthalmos appeared in the remaining eye. Facial paralysis, or some involvement of the facial nerve, was found in five cases (21, 27, 51, 53, 57), while in a sixth (70) it was present as a post-operative phenomenon, but was transitory in character.<sup>1</sup>

*Visual Field.*—Thirteen observers refer to the field of vision and in 6 of these cases (3, 5, 11, 12, 32, 50) some change was noted. Thus Wood (3) reports that the field was at first normal, but when the patient was last observed, there was present some restriction with a central scotoma. Knapp's patient (5) likewise had normal fields when first examined, but subsequently, some eight months after ligation of the carotid, the field was contracted and the color sense reduced. Calderaro (11) states that in his case the field was restricted, especially above, while in Siegrist's case (12) a post-operative embolism of the central artery was responsible for the changes manifested.

When Würdemann's patient (32) first came under

<sup>1</sup> In Pincus' case (79) the blindness, pupillary conditions, external rectus paralysis and subsequent enophthalmos that developed in the right eye (non-pulsating) were attributed to a fracture through the optic foramen and injury to the abducens and sympathetic.

observation the field was found to be "large," with a paracentral scotoma, but seven weeks after ligation of the carotid the scotoma had disappeared and the fields were normal. Zur Mühlen's case (50) is unique in that a left hemianopsia and hemianopic pupillary inaction as the result of injury to the optic tract by the lesion were present.

*Effects of Carotid Pressure.*—In a majority of the cases compression of the carotid artery on the side of the affected eye is followed by a disappearance of the bruit and pulsation, while the exophthalmos and the stasis-phenomena become less pronounced. The venous tumors disappear or become flaccid and the overlying thrill is abolished. In some instances the effect of carotid pressure may not be so complete, and may be followed only by a diminution of these symptoms, or bilateral compression may be necessary to influence one or more of the above conditions.

In Schwalbach's case (64) the murmur was intermittently abolished by pressure against the upper and back part of the orbital cavity. Woodward's<sup>1</sup> patient stopped the bruit by pressure against the side of the nose at the inner angle of the left eye. In both these cases a cure was subsequently obtained by ligation of the vessels digitally compressed. In exceptional instances carotid pressure fails to produce any effects, as was the case with Picque's patient (48). In Teitmeyer's case (71) carotid pressure did not influence the objective or subjective bruit, and it exerted no effect upon the pulsation at the upper and inner orbital angle in the case cited by Cantonnet and Cerise (73).

The cardinal symptoms of pulsating exophthalmos

<sup>1</sup> Annal d'ocul., T. cxv, p. 282, Apr., 1896. Not in the present series.

are sometimes influenced by certain postures; thus, bending or stooping may cause an exaggeration of the symptoms, while, on the contrary, the recumbent position may render them less pronounced.

In a few instances pulsating exophthalmos has been followed by *pulsating enophthalmos*, and where the latter condition develops it has been attributed to an atrophy of the orbital fatty cellular tissue.

#### PATHOGENESIS.

Ordinarily pulsating exophthalmos is a unilateral manifestation, appearing on the same side as the lesion, but the affection may be bilateral, 7 being reported in the 69 cases in the present series. If these are added to the 29 bilateral cases tabulated by previous observers among the 313 cases thus far recorded, 36,<sup>1</sup> or 11.5 per cent., have been of this type.

The explanation of bilateral exophthalmos is the following: The traumatism—for example, a fracture at the base of the skull—establishes a communication between the internal carotid artery and the cavernous sinus upon one side, which causes distention or varicose dilatation of the orbital veins. The communication between the vessels may be established by a direct rupture, because they lie in the line of fracture or because they are injured by a bone splinter. Following this venous distention on one side, there is an extension of the process by the transverse and circular sinus to the venous channels on the opposite side. Thus it will be found that in the bilateral cases one eye will almost invariably be involved before the other, or, in other words,

<sup>1</sup> This includes case No. 91 in Sattler's tabulation, which he omits in the text.

there is not a simultaneous development of pulsating exophthalmos in the two eyes.

The intimate anatomic relations existing between the ocular nerves and the cavernous sinus, and the close association of the sixth nerve with the internal carotid artery, account for the frequent ocular muscle palsies, especially of the external rectus. However, these nerves are undoubtedly implicated in some cases in their more peripheral distribution, or their involvement may result directly from basal fracture.

In this connection it is proper to refer to the distant effects of cranial trauma. It is generally recognized that the base is the weakest portion of the skull, and without going into the various theories which have been advanced to explain the mechanism of basal fracture, as the result of different types of cranial trauma, it may be said that the theory of contrecoup has been generally abandoned in the light of more recent investigation. Rawlings<sup>1</sup> states that an extension of a fracture of the vault to the base, by the shortest anatomic route, explains those basal fractures which result from blows upon the vertex, but he believes that most of the fractures of the base depend upon forces applied directly around the basic level, and that they are the result of a splitting force, the line of fracture tending to travel across the base, parallel to the original direction, but not necessarily in the same straight line.

Of the three basal fossæ, the middle is the one most frequently implicated, and it has been shown in the studies of Rawlings, as well as in those of Walton,<sup>2</sup> that in a large percentage of these cases the body of the

<sup>1</sup> Lancet, April, 1904.

<sup>2</sup> Annals of Surgery, 1904.

sphenoid is involved. The former author states that, in his experience, in 70 per cent. of the cases the sphenoidal sinus was injured, and he calls attention to the fact that this is the region in which fractures crossing between the two middle and the middle and anterior fossæ trespass, and that it is the place where fractures of the middle and anterior fossæ tend to terminate. The latter observer states that in 36 per cent. of his cases the sella turcica was implicated, and that the petrous portion of the temporal bone containing the auditory apparatus is peculiarly liable to fracture.

Referring to certain penetrating wounds, it is interesting to recall Nélaton's case of wound through the left lower lid, followed by an arteriovenous aneurysm of the right internal carotid artery in the cavernous sinus, associated with a fracture of the body of the sphenoid bone. Prior to the autopsy, Nélaton demonstrated the possibility of the lesion by experiment upon the cadaver.

While it is doubtless true that in the majority of basal fractures the great vessels at the base of the brain escape, it is also true that in most of the cases of pulsating exophthalmos originating from this cause these vessels are injured.

Considering the intimate anatomic relations existing between the internal carotid and the body of the sphenoid, as well as the apex of the petrous portion of the temporal bone, it is rather remarkable that arteriovenous aneurysm in the cavernous sinus is not more frequent, either as the result of an immediate rupture, or because the traumatism has weakened the coats of the artery and predisposed it to rupture, with or without additional trauma.

In some of the cases of pulsating exophthalmos in which the optic nerve is involved, the injury depends upon fracture through the optic foramen or upon pressure following blood extravasation. Rawlings points out the frequency with which a fracture involves the anterior clinoid processes, and suggests as a possibility that a dislocated fragment from this source might compress or lacerate the optic nerve-sheath.

In other cases visual defects may result from pressure exerted upon the optic nerve by the adjacent arterial and venous structures. In penetrating wounds, it can, of course, be injured directly by the offending body.

Those cases which have developed from trauma so slight as to make the existence of a basal fracture unlikely, must have resulted from concussion. In any event, however, the condition of the vessel walls is an important factor.

Persisting paralysis of the sixth nerve may depend upon its laceration where it grooves the body of the sphenoid, a structure frequently involved in basal fracture.

When an arteriovenous communication exists in the sinus, it so alters its pressure that a stasis is created which often causes great dilatation of the ophthalmic veins, especially of the superior, which may reach the size of a finger.<sup>1</sup> This distention passes to its anterior portion, or to the nasofrontalis and to the angular veins, and accounts for the enlarged and often compressible venous mass frequently evident at the inner angle of the orbit, the relation of which to one form of operative interference will be discussed on a subsequent page.

<sup>1</sup> This vessel, formed at the inner angle of the orbit by the union of two branches coming from the supraorbital and angular veins, empties into the anterior part of the cavernous sinus, after receiving the central vein of the retina, although the latter vessel frequently empties directly into the cavernous sinus.

On account of the exactly analogous symptoms produced, it may not be possible to differentiate those cases of arteriovenous communication in the sinus from those which are due to aneurysm of the internal carotid in the cavernous sinus and to extraorbital aneurysm of the ophthalmic artery.

Pulsating exophthalmos may also be caused by aneurysm of the ophthalmic artery in the orbit, by tumors of the orbit, and by those encroaching on it from the sinuses or from the brain.

*Autopsies.*—In the present series there are the records of 11 autopsies, 5 of the cases being of traumatic origin, 4 spontaneous, 1 of tumor, and 1 without note of the etiologic factor. The post-mortem findings may be briefly summarized as follows:

*Traumatic.*—Barnard and Rugby (51) found an abscess the size of an orange in the temporo-sphenoidal lobe. At the first bend in the canal in the petrous portion of the temporal bone, the internal carotid contained a small sacculated aneurysm filled with a clot, and associated with this there was an oval aneurysm of the carotid in the cavernous sinus. No communication was discovered. The lateral, superior, and inferior petrosal sinuses were normal. The ophthalmic artery was small, while the ophthalmic vein was not enlarged. The optic and other orbital nerves were intact.

Neff (35) reports thrombosis of the cavernous and circular sinus associated with a similar condition in the superior and inferior ophthalmic veins and their branches. No certain direct communication between the internal carotid and the cavernous sinus could be demonstrated.

Usher (41) describes two rents in the wall of the in-



ternal carotid which communicated with the cavernous sinus. There was no aneurysm of the internal carotid or ophthalmic artery and no fracture could be found. On removing the roof of the orbit a bulging of the periosteum was noted at the internal angular process of the frontal bone. Incision of this swelling revealed a tumefaction of the ocular muscles with much distention and tortuosity of the ophthalmic veins. There were two extravasations of blood, one on the ocular side of the superior oblique and the internal rectus muscles anteriorly, and the other on the orbital aspect of the external rectus posteriorly. A minute aperture in the superior ophthalmic vein lay in the center of the first extravasation.

Gibson (58) noted distention of the veins of the brain surface and a mass of dark blood at the base of the brain on the right side. The right cavernous sinus was much distended and was ruptured at its posterior end just in front of the apex of the petrous portion of the temporal bone. The anterior and posterior clinoid processes were flattened, hypertrophied, and spread out, while the pituitary body was pushed over to the left.

In this case death occurred nine years after the development of the pulsating exophthalmos, which resulted from a penetrating wound of the orbit. The reporter thinks the internal carotid was injured at the time of the accident.

Jack and Verhoeff (77) found that the right cerebral hemisphere was larger than the left, a condition which they attributed to edema. The right internal carotid was dilated at its exit from the sinus and compressed the optic nerve, which was also slightly compressed on the left side, but there was no noticeable dilatation

of the artery. There was a bulging of the dura at the site of the right cavernous sinus. The right carotid artery contained a ruptured sacculated aneurysm, 8 by 10 mm. Over a small area of the aneurysm posteriorly the wall was thin and friable. The cavernous sinus on the left side was absent and was replaced by a single small vein in continuity with the ophthalmic vein. The other venous sinuses were normal. The carotid arteries showed advanced arteriosclerosis. Both optic nerves were atrophic, most marked in the right one, in which the papillo-macular bundle was especially affected. The retinal ganglion cells had disappeared and the nerve-fibers were atrophic. One small retinal hemorrhage was found.

*Spontaneous Cases.*—Karplus (1) describes on the left side a sacculated aneurysm of the internal carotid, 1 cm. in length, which communicated with the cavernous sinus. In the aperture was a thrombus 3 cm. in length. The left hemisphere of the brain was softened and the cerebral vessels were sclerotic. The heart muscle was in a state of fatty degeneration.

Debayle's (7) patient died from rupture of a carotid aneurysm near the aorta. The internal carotid artery was the seat of an odd type of endarteritis and contained a rupture which communicated with the cavernous sinus.

Cantonnet and Cerise (73) found sclerosis of the coronary vessels of the heart and of the circle of Willis. The internal carotid was dilated at its entrance into the sinus, while at the outer anterior portion of the sinus the artery contained a perforation. In the orbit, between the optic nerve and the superior rectus muscle, there was an aneurysmal dilatation, which was probably

arteriovenous. A distended vein extended to the aneurysm from without, and from the same structure a diverticulum passed vertically downward toward the inferior orbital fissure. The ophthalmic artery was much reduced in caliber.

Grunér (9) noted marked blood infiltration of the cavernous sinus. The wall of the internal carotid was thin, but no rupture could be found. The orbit failed to present any abnormalities.

*Tumor.*—Van Duyse (44) discovered in the right anterior fossa a hard globular mass, the size of an egg, which extended beyond the median line to the left side. The internal wall of the right orbit bulged laterally and there was an involvement of the right nasal fossa and effacement of the left fossa owing to marked lateral displacement of the septum. The ethmoidal, sphenoidal, frontal, and maxillary sinuses were involved. Metastatic growths were found over the left half of the pons, below the left frontal lobe, and in the middle fossa of the skull. In the ventricles there was a marked serous effusion. The origin of the growth was supposed to be the ethmoidal cells.

Brandes' (62) post-mortem examination revealed calcification of the internal carotid with rupture of the artery in the cavernous sinus, and in this last structure was found a gelatinous mass. There was atrophy of the oculomotor, the ophthalmic division of the trigeminus, and the sympathetic, as well as of the optic nerve from the chiasm to its entrance into the orbit. Brain softening was present in the region of the Sylvian fossa. The abducens nerve was not found.

The three cases which follow are included in the

present tabulation, but belong to the atypical or doubtful series.

Armaignac's (24) case is referred to in the discussion of Aubaret's case (23). Death occurred after failure of double ligation of the carotids for supposed orbital aneurysm. The reporter states that no trace of an aneurysm could be found.

Ercklentz's (14) patient died of gastric carcinoma. The upper and posterior walls of the orbit were absent, so that the space occupied by the globe formed with the middle fossa of the skull one large cavity divided by a membrane representing the dura mater and the periosteum of the orbit, which acted as a support to the orbital contents. The frontal lobe of the brain projected into the orbital cavity, forced the globe forward, and communicated its pulsation directly to the eyeball.

Maynard and Rogers (54) found the right optic nerve spread out into a sac containing clear fluid, which passed through a greatly dilated optic foramen. The orbital portion was much thickened. The dilated portion was funnel-shaped and continuous by its base with the under surface of the brain, and measured 1 inch in its transverse and  $\frac{1}{2}$  inch in its vertical diameter. The left optic nerve was somewhat larger than normal and contained a small quantity of fluid in its center posteriorly, while its anterior orbital portion was smaller than normal and atrophied. The lateral and third ventricles were much dilated. The latter were continuous with the sac at the base of the brain. No optic chiasm could be found. There was some deformity of the orbit.

To summarize: In 6 of these 11 cases an actual arteriovenous communication was demonstrated, while

in 3 others, although the rupture was not found, it is possible that it existed, because, as Delens, Rivington, and Sattler pointed out long ago, it is difficult to be positively certain whether or not there has been in a thinned wall of the carotid a small communication which has escaped detection. Touching this point the following data are important in connection with the 3 cases without demonstrable rupture above referred to, namely, that in Neff's traumatic case (35) eleven months elapsed before the death of the patient; in the other traumatic case, reported by Gibson (58), the patient died nine years after the accident; and in Grüner's spontaneous case (9) the patient succumbed five days after ligation of the carotid. Unfortunately the original article was not available, but the abstract of the autopsy findings indicates the possibility that a rupture existed.

Up to the middle of the year 1907 40 autopsies on cases of pulsating exophthalmos have been recorded. They may be grouped as follows:<sup>1</sup>

Rupture of the internal carotid in the cavernous sinus in 14 cases (Nélaton 2 cases, Hirschfeld, Leber, Baron, Nunneley, Stulp, Grub and Tscherning, Usher (41), Jack and Verhoeff (77), Brandes (62), Debayle (7), Karplus (1), Cantonnet and Cerise (73)).

Possible rupture of the internal carotid in the cavernous sinus in 10 cases (Blessig, Gendrin, Wecker, Bowman, Morton, Oettinger, Coggins, Neff (35), Gibson (58), Grüner (9)). In 4 of these autopsies no arterial lesion was found, but Sattler believes that a rupture may have been overlooked. In Coggins' case of aneurysmal dilatation of the internal carotid in the

<sup>1</sup> The autopsy records prior to the present series are quoted from Rivington, Sattler, Keller, and Reuchlin.

cavernous sinus, according to Keller a rupture may have been present. In Blessig's case the autopsy showed that the internal carotid was dilated, and the same vessel was diseased in Gendrin's case, and in both of them Sattler seems to favor the idea of a possible rupture.

Aneurysm of the internal carotid in 3 cases (Dempsey, Gerhardt and Barnard and Rugby (51)).

Aneurysm involving the ophthalmic artery in 3 cases (Guthrie, Carron du Villard, Nunneley).

In Dempsey's case, there was also an aneurysm of the ophthalmic artery, and in the patient operated upon by Lewis (75) a similar lesion was found.

Tumors in 6 cases (Levoir (cancerous), Nunneley (pseudoplasm), Schells (glioma), Alexander (vascular growth), De Bono (adenoangioma), Van Duyse (44) (fibrosarcoma).

Emyrs Jynes reports caries of the orbital wall with an abscess of the orbit, which communicated with a similar lesion in the brain. In Gerhardt's case, above mentioned, two-thirds of the roof of the orbit was wanting, a condition which must be considered in its relation to the pulsation. In this connection mention may be made of Erklentz's case, which is included among the atypical cases.

Aubry after the death of his patient injected the arterial system, but failed to find any arterial lesion, although there was marked dilatation of the ophthalmic vein. The cavernous sinus was greatly dilated and communicated with the ophthalmic vein, but terminated behind in a cul-de-sac, the communication with the inferior petrosal sinus being cut off.

In 2 cases (Harlan, Gauran) the patients died of other affections after the pulsating exophthalmos had

been cured, and the autopsies failed to detect any abnormalities.

#### DIAGNOSIS AND DIFFERENTIAL DIAGNOSIS.

The diagnosis of pulsating exophthalmos is a comparatively simple matter, although the determination of the underlying etiologic factor is often difficult, especially as the symptoms of rupture of the internal carotid into the cavernous sinus may be produced almost exactly by an aneurysm of the internal carotid in the cavernous sinus and by an aneurysm of the ophthalmic artery.

Intensity of the bruit, especially if it is continuous with systolic accentuations or if it is associated with a *bruit de piaulement*, indicates more strongly the presence of arteriovenous communication than either of the other cardinal symptoms of this affection. The venous masses at the inner angle of the orbit, especially if they possess pulsation and thrill, are of decided diagnostic import, but several weeks are required for their development. If after traumatism, particularly a blow upon the head, there follows a period of unconsciousness, associated with vomiting and hemorrhage from the nose, mouth, or ears, and the symptom of lesion of some of the cranial nerves and of those which furnish the ocular supply, and especially of the facial and auditory nerves, there is reason to believe that a communication between the carotid artery and the cavernous sinus has been established as the result of a basal fracture.

The facial nerve is much more frequently involved in basal fracture than the ocular nerves. This is shown in Bruns' analysis<sup>1</sup> of 275 cases, among which he found this

<sup>1</sup> Jahresbericht f. Ophth., 1903, S. 433.

nerve implicated in 83 instances, while the abducens nerve was affected in only 10 cases, 3 of which were bilateral.

In the 54 traumatic cases immediately under consideration the ocular symptoms were preceded by unconsciousness in 24 cases; by vomiting in 10; and by hemorrhage from the nose, mouth or ears in 16.

Among the spontaneous cases, Golowin's patient (10) was unconscious prior to the development of the exophthalmos, while in Würdemann's case (32) vomiting occurred. In Calderaro's case (11) there were repeated hemorrhages from the nose for two months, while in the case reported by Wiesinger (36) hemorrhages from the nasal cavity occurred during a period of two years.

As a rule, pulsating exophthalmos occurs on the same side of the head as the trauma. Penetrating wounds of different types, however, may be responsible for exceptions to this rule, as, indeed, may other varieties of trauma, so that the symptoms appear on the side opposite to that on which the injury occurred. This took place in cases 11, 19, 27, 56, 60, and 79. In the last of these cases reported by Pincus following trauma to the right side of the head, swelling and ecchymosis of the lids, blindness, and palsy of the ocular muscles appeared on this side; but pulsating exophthalmos developed in the left eye seven to nine weeks after the accident. These early symptoms were attributed to fracture of the right orbit and intraorbital hemorrhage.

In a similar manner, intraorbital hemorrhage in v. Hippel's<sup>1</sup> case provoked a left exophthalmos after

<sup>1</sup> Cited by Sattler.



trauma to the left side of the skull which was followed by pulsating exophthalmos of the right eye. In Calderaro's case (11) a pulsating exophthalmos of the left eye developed as the result of trauma over the right eyebrow, but a pulsating murmur or noise in the left ear immediately after the injury was quite significant.

After a rupture of the internal carotid in the cavernous sinus, one of the first symptoms noted by the patient is the subjective bruit, which is often referred to the affected side of the head, although it may be general or be referred to both ears, as in the case of Mackay's patient (76). Following the subjective and objective bruit, the exophthalmos appears, but in some cases these symptoms are noted simultaneously. The pulsation next develops, and this in turn is followed by the venous masses. At times, however, pulsation can be detected over these venous masses, while it may be absent in the globe itself, as occurred in case 47 and in others.

While the bruit, exophthalmos, and pulsation may all arise within a few days after the accident, or be deferred to a much later period, the venous masses are always a late manifestation, and, according to Keller, do not develop before the end of the first month after the trauma. In the spontaneous cases the patients are frequently conscious of something having given way within the skull, and quickly note the subjective bruit. Within the course of a few days the other symptoms become manifest.

As already noted, these cases usually occur later in life than the traumatic ones and are often associated with aneurysmal formations in the carotid or degenera-

tive changes in the walls of the vessels, as, for example, in cases 1, 7, 42, and 73.

A number of the cases occurring in the earlier periods have been in women associated with pregnancy.

It is impossible to differentiate between an extra-orbital and an intraorbital aneurysm of the ophthalmic artery, and, as Bull<sup>1</sup> has pointed out, if a true aneurysm of the ophthalmic artery within the skull produces pulsating exophthalmos, it must be of rapid development, otherwise the signs of stasis and pulsation in the orbit would be absent, on account of the establishment of collateral circulation.

Vascular tumors of the orbit may be confused with pulsating exophthalmos, but in the former the symptoms develop more slowly, the orbital growth may be palpable, and efforts to reduce the exophthalmos encounter greater resistance than in the latter, while the murmur, if present, is feeble, intermittent, and often heard best over the corresponding temple. So, too, the pulsating venous mass is apt to be situated at the outer angle, or out and up or out and down, rather than at the upper and inner angle, its usual position in true pulsating exophthalmos.

In all doubtful cases there should be a thorough examination of the accessory cavities and sinuses. Thus in Van Duyse's case (44) the lesion was supposed to be an aneurysm of the ophthalmic artery prior to the discovery of a tumor in the right nasal fossa. The *x*-rays may be utilized, particularly in fractures of the skull, and in gunshot injuries with retention of the bullet or shot, and to demonstrate the pres-

<sup>1</sup> "System of Diseases of the Eye," edited by Norris and Oliver, vol. iii, 1898, p. 28.

ence, absence, or loss of the osseous walls of the orbit. Unfortunately it is impossible to determine exactly what rôle trauma plays in the development of some of the tumor-cases. In a few instances orbital encephaloceles have been mistaken for pulsating exophthalmos, but they are unlikely to be associated with a bruit and ophthalmoscopic examination is negative.

#### PROGNOSIS.

The prognosis of pulsating exophthalmos *quoad vitam* is favorable. In some cases death has resulted from the conditions upon which the development of the affection has depended. In certain other cases, in spite of the persistence of the symptoms, the patients have been able to carry on lines of work free from decided muscular efforts. In a small number of these cases spontaneous cure has resulted. The prognosis *quoad visum* should be distinctly conservative, and the danger to vision has been fully described (see table, p. 26).

#### TREATMENT.

An accurate analysis of the effects of the various measures, surgical and medical, which were adopted for the relief of the patients whose case histories are recorded in the present series is difficult because a number of the subjects of the affection under consideration were submitted to more than one line of treatment or more than one operation. These various measures may be classified as follows: (1) Ligation of the larger blood-vessels of the neck; (2) operations upon the orbit; (3) compression of the common carotid; (4) direct compression of the venous swelling in the

eyelids and angle of the orbit; (5) gelatin injections; (6) the administration of certain drugs and rest in the recumbent posture.

In the present series of cases<sup>1</sup> 34 ligations of the common carotid on one side were performed with cure or improvement in 17, or 50 per cent.; recurrence in 7, or 20.5 per cent.; negative results in 6, or 17.6 per cent., and deaths in 4, or 11.7 per cent.<sup>2</sup>

In 2 cases of ligation of the common carotid, not included in the percentage just recorded, death occurred, but not as the result of the operation. In Barnard's and Rugby's patient (51) a revolver wound of the mouth was responsible for the subsequent developments of the case. After carotid-ligation, pulsation disappeared on the tenth day, but owing to the pressure of a brain abscess a craniotomy was performed two months later, which resulted, after a few days, in the death of the patient. Bertram (26) reports a recurrence three to four months after ligation, with subsequent death of the patient from suicide.

In 2 cases of the present series double ligation of the common carotid was resorted to. Hansell's patient (56) suffered a complete recurrence some time within a month after the first ligation was performed by Keen; death took place five days after the second ligation. In Van Duyse's case (44) no result followed the first ligation; sixteen months later the second carotid was

<sup>1</sup> This includes the case first reported by Reuchlin, and later by Schlüpmann, after the carotid had been ligated.

<sup>2</sup> If the first ligation in Hansell's case (56) is included, the results would be as follows:

Cured or improved.....	17, or 48.6%
Recurrence.....	8, or 22.8%
Negative results.....	6, or 17.1%
Deaths.....	4, or 11.4%

ligated and this operation was followed by a distinct improvement. One year after the last operation the patient died from fibrosarcoma.

Würdemann (32) cured his patient with spontaneous pulsating exophthalmos by ligating the common and external carotid, while Thierry (27) was equally successful after ligation of the common and internal carotid.

Ligature of the external and internal carotid was practised 6 times with the following results: One cure (Usher, 42); two improvements (Siegrist, 12, and Lambert, 18); one recurrence (Wiemuth, 19), one negative result (Burghard and Pritchard, 46), and one death (Usher, 41). In Gifford's case (80) ligation of the external carotid was performed with negative results.

Ligature of the internal carotid was practised 6 times with the following results: In Debayle's case (7) a cure was obtained, but the patient died one month after ligation as the result of a rupture of a carotid aneurysm near the aorta. Improvement was noted in 4 cases (Sobernheim 30, Frazier 52, Delanglade and Pons 70, and Cushing 74), while in Houillon's case (22) the results were negative.

In so far as the results of ligation of the common carotid are concerned, it is interesting to quote from Reuchlin the operations on this vessel which have been recorded prior to the beginning of the present series. They are as follows: In 116 cases of ligation of the common carotid a cure or essential improvement resulted in 80 (or 68.8 per cent.), negative results in 25 (or 21.5 per cent.), and death in 11 (or 9.5 per cent.).

If Reuchlin's figures and those of the present series

are added together, the result is as follows: Ligatures of the common carotid, 150 cases, with cure or improvement in 97 (64.6 per cent.); failure in 38 (or 25.3 per cent.); death in 15 (or 10 per cent.).<sup>1</sup>

Although the internal, external, and common carotid have each been ligated for the relief of pulsating exophthalmos, the last named vessel has been most frequently selected for operation. Reid, however, prefers ligation of the external and internal carotid, inasmuch as he believes that this procedure diminishes the chances of the re-establishment of the circulation through the external carotid. In the present series of cases this operation was performed 6 times, with 1 cure, 2 improvements, 1 recurrence, 1 negative result, and 1 death—results, it would seem, which do not indicate that this procedure should be preferred to ligation of the common carotid.

A certain number of ligations of the carotid are followed by disturbance of the central nervous system, which usually manifests itself as a partial or complete hemiplegia, often associated with aphasia. Disturbance of cerebral functions together with complications at the seat of ligation, such as secondary hemorrhage and infection, are the chief dangers of this operation.

Thus in the present series brain symptoms occurred in 5 cases (3, 56, 62, 65, and 77) after ligation of the common carotid; once (27) after ligation of the common and internal carotid, and once (12) after ligation of the external and internal carotid. In Wood's case (3)

<sup>1</sup> If the first ligation in Hansell's case (56) is included among the failures, the result is as follows:

Cure or improvement in.....	97, or 64.2 %
Failure in.....	39, or 25.8 %
Death in.....	15, or 9.9 %

after ligation, the patient was irritable and easily excited and his speech was thick and slurred—symptoms which disappeared at the expiration of one week. Hansell (56) reports that three days after the second common carotid ligation there occurred a series of convulsions, followed the next day by paralysis of the left side and almost continuous convulsions.

In Brandes' case (62) immediately following ligation there occurred a paresis of the left face with deviation of the tongue to the same side, and on the next day paresis of the whole left side.

Paresis and numbness of the left upper extremity were prominent symptoms in the case reported by Barley (65), and in Jack's and Verhoeff's case (77) the ligation was followed by difficulty in swallowing and twenty-four hours later by hemiplegia and delirium, which persisted, with few normal intervals, until the death of the patient four weeks later.

Thierry (27) reports that fourteen days after ligation of the common and internal carotid a gradually increasing paralysis of the right arm associated with impaired sensation developed. Delirium and psychic disturbances were also present. Thirteen days after ligation of the external and internal carotid Siegrist's patient (12) suddenly fell to the floor with complete paralysis of the right side. There was slight bilateral facial twitching, more marked on the left side; the tongue was protruded straight and the speech was affected. After a few minutes speech was again normal and some motion had returned in the upper extremity; at the expiration of four hours all these symptoms had disappeared. This patient is the one previously referred to, who sustained an embolism of the central

artery of the retina after ligation. If the 5 cases of cerebral disturbance following ligation of the common carotid just referred to are included with similar cases reported by Sattler, Keller, and Reuchlin, 8.8 per cent. of the total number of ligations of this vessel have been followed by this complication, and if cases 12 and 27 are also incorporated, the result is 9.8 per cent.

While modern aseptic surgery has reduced the number of infections, it remains to be seen whether the actual mortality of ligation of the common carotid will be reduced. In this connection reference may be made to three deaths from this source which occurred in Sattler's series.

Siegrist, in an excellent article on carotid ligation, refers to 997 ligations of the carotid that have been performed for various conditions, and in 42 of them some disturbance of the eyes resulted. He does not attribute these complications directly to the interruption of the circulation, but rather to infection, injury of the sympathetic during operation, pathologic processes in the brain and its vessels, heart weakness, ascending thrombosis of the internal carotid, etc.

Siegrist's statistics also show that the mortality of carotid ligation is much lower for pulsating exophthalmos than for other affections, such as tumors, aneurysm, and hemorrhage.

In a certain number of cases of failure to relieve the symptoms of pulsating exophthalmos by ligation of one carotid, the vessel upon the opposite side has been tied. Thus among the 313 cases thus far reported, that is, to July, 1907, there were 11 double ligations, and 2 of these (44 and 56) occurred in the present series. Exclusive of Van Duyse's case (44), a sarcoma of



ethmoidal origin, 10 double carotid ligations have been performed, and all of them for the relief of cases of traumatic origin, with the following results: 6 successes, 2 failures, and 2 deaths.

In view of the fact that ligation of the superior ophthalmic vein, as will presently be shown, has given such uniformly good results, it is likely that in the future double ligation of the carotid for pulsating exophthalmos will be performed in still fewer cases.

A successful ligation of the carotid is usually followed by an immediate disappearance of the bruit and the pulsation. The venous masses become flaccid or vanish, the venous stasis in the lids and conjunctiva and the exophthalmos gradually become less marked, although traces of the last named symptom may continue for months. The subsidence of the ocular muscle paralyses, if they have been present, is, as a rule, gradual, and, as has already been noted, palsy of the external rectus usually is the most persistent. It should be remembered, however, that an associated fracture of the base of the skull may be responsible for the continuance of exterior ocular muscle paralyses and not arteriovenous aneurysm or its peripheral effects.<sup>1</sup>

Recurrence of the symptoms of pulsating exophthalmos is not infrequent after ligation and occurred 8 times (19, 20, 22, 26, 45, 46, 52, 56) among 38 ligations (36 cases) in the present series. Among these the interval of relief varied from one day to four months (45). In the report of Wiemuth's case (19) the re-establishment of the circulation through the vertebral artery is given as

<sup>1</sup> According to Siegrist, old age does not contraindicate carotid ligation for the relief of pulsating exophthalmos, provided there is no cardiac disease and the patient's nutrition is unimpaired. To avoid the dangerous effect of a general anesthetic local anesthesia may be employed.

the cause of the recurrence, which developed three months after the ligation of the common carotid. Subsequent surgical procedures, as well as compression of the carotid, were unsuccessful in controlling the symptoms.

*Orbital Operation.*—Lansdown, in 1873, on the suggestion of Charles Higgens,<sup>1</sup> ligated successfully dilated vessels at the inner angle of the orbit, and Noyes,<sup>2</sup> in 1881, recorded a successful result after operation in the orbit for the relief of pulsating exophthalmos, although the importance of the ophthalmic vein in its relation to this affection was appreciated by earlier observers.

Thus Rivington,<sup>3</sup> referring to the treatment of his case of pulsating exophthalmos, writes: "The great desideratum appeared to me to be, to obtain the obliteration of the dilated ophthalmic vein. The agent best adapted for effecting this object seemed to be a solution of perchlorid of iron."

Because of the interest surrounding Noyes's case, and because it has been lost sight of by some authors, it has been accorded a comparatively full review.

Noyes's patient came under observation four years after the spontaneous development of an exophthalmos, and presented a mass at the inner and lower angle of the orbit which was at first regarded as a solid growth. Subsequent careful examination revealed a long, tortuous vessel coming forward from the inner and lower angle of the orbit and returning with a loop to enter the orbit by what seemed to be an exceedingly large branch of the angular artery. Thinking that he was in the presence of a purely vascular anomaly,

<sup>1</sup> A Manual for the Practice of Surgery, by Thomas Bryant, 1885, p. 317; and Trans. Ophth. Soc. U. K., xxvii, 1907, p. 187.

<sup>2</sup> Trans. Amer. Oph. Soc., 1881, p. 308.

<sup>3</sup> Medico-Chir. Trans., vol. lviii, 1875.

Noyes decided to ligate the angular artery and afterward expose and tie this tortuous vessel. The ligation having been performed, he cut down upon the distended vessel, which was as large as a goose-quill, traced it backward, placing upon it one ligature after another, and cutting between them until he was satisfied that he was dealing with a vein, which he believed to be the inferior orbital vein coming from the sphenomaxillary fissure, where he finally tied it. Healing was uneventful and the operation resulted in a complete cure, which Noyes attributed to the formation of a clot as far as the cavernous sinus, where it closed the aperture of arteriovenous communication.

Concluding his article, he writes as follows: "Without interfering with the circulation in other directions, I succeeded in curing a pulsating exophthalmos by a local operation, which is not recorded to have been done in any of the cases collected by Sattler. A resort to ligation of enlarged orbital vessels has been done several times after having ligated the carotid, but in my case the cure was effected without touching the carotid. The superior orbital vein is the one usually distended in these cases, and my case must be noted as exceptional in this regard."

Woodward,<sup>1</sup> in 1894, after a recurrence following carotid-ligation performed five months previously, ligated two pulsating vessels at the inner angle of the orbit and secured a complete cure. It has been suggested, inasmuch as the veins may assume arterial characteristics in this affection, that in this case the ligated vessels were not arteries but veins with the much thickened walls.

<sup>1</sup> Ann. d'ocul., T. cxv, 1896, p. 282.

In 1897 Szimanowsky,<sup>1</sup> after an unsatisfactory result from ligation of the common carotid, suggested as a suitable operation ligation of the superior ophthalmic vein before ligating the second carotid. It appears that Golowin about the same time,—Feb., 1897,—and ignorant of the suggestion of Szimanowsky, resorted to a primary bilateral ligation of the superior ophthalmic vein in an atypical case of pulsating exophthalmos. Marked periorbital venous distentions were evident, and over them there were pulsation and thrill. A bruit was present, but there was no exophthalmos, its absence being explained by Golowin as due to atrophy of the cellular tissue of the orbit. The symptoms were attributed to an arteriovenous aneurysm of the orbit of spontaneous development.

In 1898 Lasarew,<sup>2</sup> after an unsuccessful ligation of the carotid in a spontaneous case of pulsating exophthalmos, tied the superior ophthalmic vein and excised a venous ectasia in the lid with complete success. The incision was made parallel to the orbital margin. The operation was followed by headache, vomiting, and slowing of the pulse.

In the same year Dollinger<sup>3</sup> obtained a cure after ligation and resection of the superior ophthalmic vein in a case of pulsating exophthalmos reported by Bodon. The patient had been previously subjected to a bilateral ligation of the common carotid, and the orbital operation was performed five months afterward.

Golowin,<sup>4</sup> in 1899, secured success in the treatment

<sup>1</sup> Arch. f. Aug., 1897, S. 29; also cited by Sattler and Golowin.

<sup>2</sup> Cited by Sattler and Golowin, Klin. Monatsbl. f. Augenheilk., xl, 1, p. 343.

<sup>3</sup> Deutsche Zeitschr. f. Chir., li, S. 605.

<sup>4</sup> Cited by Sattler, Klin. Monatsbl. f. Augenheilk., xliii, 2, 1905, p. 1.

of a traumatic case by ligating the superior ophthalmic vein after resection of the outer orbital wall. His operation was not preceded by carotid-ligation.

In 1903 Wiesinger (36) reported a case of pulsating exophthalmos associated with fracture of the skull, for the relief of which, after failure of local compression, the common carotid was tied, and fourteen days later the superior ophthalmic vein was subjected to a similar operation and the external venous ectasia was extirpated. These procedures resulted in cure.

As a primary operation Sattler (47) successfully ligated and resected the left superior ophthalmic vein. He was prepared to ligate the common carotid should severe hemorrhage have demanded such intervention. This case, reported in 1904, was one of arteriovenous aneurysm in the cavernous sinus attributed to a bone splinter. The operation resulted in cure, but was followed by pain in the left occipital region and conspicuous slowing of the pulse, which disappeared by the seventeenth day.

After failure of local and carotid compression, as well as ligation of the common carotid, Schwalbach (64), through a supraorbital incision, tied and resected the superior ophthalmic vein. This case developed as the result of an injury from a knitting-needle, and subsequent to the orbital operation there were no unfavorable symptoms, the patient being discharged from the hospital at the end of eight days.

Pritchard (46), in 1904, reported recurrence of symptoms in a traumatic case of pulsating exophthalmos after carotid-ligation, which he had observed in 1901. In 1905 the patient came under the observation of Burghard, who ligated the external and internal

carotids with negative results. This operation was shortly followed by ligation of the angular vein; except for a slight temporary recurrence of the symptoms the result was entirely successful.

Gifford (80) reports an interesting traumatic case in which the external carotid was ligated by Dr. Jonas in 1902, with negative results. Within a month the common carotid and a much distended vein in the upper lid were ligated. Immediately following this operation there was marked pain and the exophthalmos increased to such an extent that the lids were united to protect the cornea. These symptoms gradually subsided, but considerable exophthalmos and a subjective bruit persisted. Three years later when the patient was again examined, a pulsating mass had formed beneath the eyebrow. A supraorbital incision was made and the enlarged vein ligated near the apex of the orbit. The mass beneath the brow proved to be a vessel filled with solid blood, and Gifford regarded his previous ligation in the lid as the starting-point of the mass. No unfavorable symptoms followed the second venous ligation.

Lambert (18), in 1902, reported a case of traumatic pulsating exophthalmos in which ligation of the internal and external carotid, together with the lingual and facial branches, had partially relieved the symptoms, but had failed to check hemorrhage from a mass of orbital tissue projecting from the eyeball and the inner surface of the lower lid near the inner canthus. Three weeks after this mass of vascular tissue had been dissected from the orbit, there was no recurrence of the hemorrhage and the patient could almost close the lids.

In 1907 Park Lewis (75) made a dissection of the orbit in order to investigate a traumatic aneurysm of the ophthalmic artery. The vessel was dilated to the size of the little finger and was successfully ligated just within the orbit. The reporter calls attention to the fact that ligation within the orbit controlled the symptoms in spite of the fact that the aneurysm was partly extraorbital.

Jack (78) has reported a case of traumatic pulsating exophthalmos in which the operative procedure consisted in making deep incisions into the orbital tissue, above and below, through the lids. This operation was followed by profuse hemorrhage and the cornea subsequently ulcerated; although there was a slight recurrence of symptoms, a cure finally resulted. This favorable result was attributed to a thrombosis extending backward, on account of the free division of the vessels.

Excluding Golowin's first case, of the operations performed in the remaining 14 only 3 were concerned with arterial ligation; in one of these there was a simultaneous venous ligation, and in another it is possible that some of the vessels which were tied may have been veins. The superior ophthalmic vein was operated upon in seven cases; the inferior ophthalmic vein in one, the angular vein in one, and the smaller orbital veins in the remaining three.<sup>1</sup> The results in all of these cases were successful and the majority of them were of traumatic origin, Noyes, Woodward, and Lasarew being the only reporters of cases of spontaneous development, although Golowin's atypical case also belongs to the latter group.

All of the seven cases of operation upon the superior

<sup>1</sup> This includes Lansdown's and Higgins's case; the reporters were uncertain whether veins or arteries were tied.

ophthalmic vein have been reported since 1897, and in view of the uniformly successful results it would seem that this procedure should be considered before ligation of the carotid, and certainly should precede ligation of the second carotid, provided the first operation has failed to produce the desired result.

If a distended vein can be felt in the orbit, we agree with Gifford that its ligation should be the operation of choice, and inasmuch as in at least 28 per cent. of the cases such a pulsating venous mass is evident, it is probable that in the future orbital operation will take precedence and the records of its performance will increase in number. Sattler, Burghard and Higgens express similar opinions.

Although thus far no ultimate unfavorable results have followed the orbital operation, in the cases reported by Lasarew and Sattler temporary and somewhat alarming "brain symptoms" developed, due probably to the extension of the venous thrombosis into the cranial cavity. Gifford's first venous ligation was likewise followed by temporary unfavorable conditions. Rivington, in 1874, following the example of Bourguet and Desormeaux, injected 5 minims of the perchlorid of iron into the venous mass which was present in his case of pulsating exophthalmos. This injection was followed by the production of a small coagulum in the ophthalmic vein at its anterior part, and an alteration in the character of the bruit and the pulsation. Considerable local pain, sick headache, and vomiting also developed, with an increase in the amount of swelling, chemosis of the conjunctiva, and, later, corneal involvement. The pulse was 48, while the temperature remained normal. The common carotid was subsequently successfully ligated.



Although orbital venous ligations and operations have thus far been successful, they have been few in number, and in view of the temporary unfavorable symptoms which developed in three of them, the possibility that thrombosis of the basal sinuses may arise must not be ignored.

*Compression of the Common Carotid.*—Compression of the carotid was resorted to in 12 of the present series of 69 cases, with a cure in only one of them (17), which was spontaneous in origin.

Three cases (6, 13, and 57) were improved. In one (13) reported by Bossalino as a cure, a faint murmur and slight exophthalmos persisted, and hence it should be included with the list of improvements. In Braunschweig's traumatic case (57) a distinct improvement was noted after compression. Digital compression for half an hour at a time three times a day was at first resorted to, but later mechanical pressure was substituted for this and was maintained for considerably longer periods of time. In the remaining cases (19, 26, 35, 44, 50, 61, 64, and 79) the results were practically negative, although in two of them (69 and 79) there was a slight amelioration of the symptoms, but so slight that it cannot be regarded as a lasting improvement. One patient (79) after his discharge from the hospital, continued the compression with a crude mechanical device while lying in bed.

In a case previously reported by one of us (de Schweinitz), the patient utilized a similar contrivance—a stick, the end of which was padded—with a certain degree of success. In Schwalbach's case (64) direct compression of the venous mass was resorted to in conjunction with carotid compression. In two other cases

(36 and 76) the venous swellings were directly compressed, without satisfactory results, although in one of them (76) this procedure, associated with rest in bed and the internal administration of iodid of potassium, was followed by a temporary improvement.

Among 68 cases of digital compression collected by Reuchlin there were 15 cures or distinct improvements (22.1 per cent.), and 53 negative results, or 77.9 per cent.<sup>1</sup> If we include these cases with those of the present series (excluding Van Duyse's case (44), which was due to a sarcoma), we have 79 cases, of which 19 were cured or improved (24.05 per cent.), and 60, or 75.95 per cent., were failures.

It is generally conceded that the cases offering the best prospects for successful treatment by compression are those of spontaneous origin, because they are frequently associated with changes in the coats of the vessels, which facilitate the formation of clots. This procedure effects less satisfactory results in traumatic cases because, especially in those due to gunshot wound and penetration of the carotid by a bone splinter, there is a wide rent in the vessel wall. Moreover, these traumatic cases develop at an earlier period than the spontaneous ones, and are less apt to be associated with disease of the vessels at the base of the skull.

Digital compression, the usual method employed, is generally more satisfactory than compression by mechanical means; but in patients with thick and short necks neither of these methods is of much advantage. Thus, in a case of spontaneous pulsating exophthalmos

<sup>1</sup> Reuchlin's figures are really 68 cases, with 15 cures or improvements (22.1 per cent.) and 52 failures, or 76.5 per cent. We have included as a failure a case in Sattler's series (Morton and Harlan's case: *Trans. Amer. Oph. Soc.*, xi, 1876, p. 332), which Reuchlin includes in his total number of cases but does not classify.

reported by Belt (6), this physical peculiarity prevented the application of this method of treatment until at least a month after the development of the affection.

In the beginning digital compression should be limited to one or two minutes, as the shutting off of the circulation may be followed by certain "brain symptoms," especially vertigo, which was a complication in cases 50 and 57; paresthesia of the arm was also present in the latter case. In case 79 compression was followed by vertigo, weakness, convulsive movements in the left arm, and disturbance in speech. In spontaneous cases, interrupted digital compression, maintained for periods of five to fifteen minutes, may bring about a good result, but in traumatic cases, owing to the conditions already described, it is usually necessary to maintain uninterrupted compression for several hours if a satisfactory effect is to be obtained.

*Gelatin Injections.*—Gelatin injections were resorted to in 3 cases (20, 22, and 44), and in one of these effected a cure. Reynier's case of traumatic exophthalmos (20), which developed a recurrence eighteen days after ligation of the common carotid, was at first treated with an injection of 5 c.c. of serum-gelatin. Subsequently, upon the suggestion of Paulesco, the amount was increased to 100 c.c., and then to 200 c.c., and eventually a cure was obtained.

In Houillon's (22) traumatic case the results were not so successful. Injections of serum-gelatin were employed after a recurrence following a ligation of the common carotid, but they proved futile, as did a subsequent ligation of the internal carotid. Similar injections were likewise resorted to in Van Duyse's case (44) at a time when the symptoms were believed to de-

pend upon an aneurysm of the ophthalmic artery. Needless to say, they were inefficient, as the disease proved to be fibrosarcoma. In this connection it is interesting to refer to a case of aneurysm of the ophthalmic artery reported by Lancereaux and Paulesco<sup>1</sup> cured by repeated injections of serum-gelatin.

*Drugs and Medicinal Measures.*—In 6 cases of the present series (11, 28, 59, 69, 72, 76) no form of operative procedure was employed, the treatment being restricted to medicinal measures. All of these cases were traumatic in origin except one (72), which belongs to the spontaneous group. In this case, reported by Gasparini, a cure followed administration of potassium iodid and the instillation of adrenalin. The reporter believes the favorable result should be attributed to the latter drug.

Evans (69) reports an improvement in a traumatic case after rest in bed and the internal administration of potassium iodid and calcium chlorid, while Thierry reports one (28) with improvement after a course of iodid of potassium. In the case of Punzo (59), who was himself the subject of this affection, an improvement was noted after the administration of trional and bromid, together with the use of cold compresses and leeches. In the cases reported by Mackay and Calderaro (76 and 11), rest in bed and the exhibition of potassium iodid yielded negative results in the first instance; the employment of bandages, leeches, and the galvanic current was equally unsuccessful in the second case.

Rascalou's statement that pulsating exophthalmos without treatment never eventuates in cure is not correct, because a few instances of spontaneous healing are on

<sup>1</sup> Münch. med. Wochenschr., 1907, No. 14, S. 700.

record, and in certain other cases in which a cure is attributed to remedies so trivial in their action that it is difficult to believe that they themselves could have had any positive effect the same explanation is permissible.

In Oliver's traumatic case, Frazier ligated the right common carotid and the left internal carotid and secured some relief from the intensity of the symptoms. Two years and eight months after the last ligation the patient collided with a playmate, and during that day noted a marked diminution in the bruit and the exophthalmos, and by the following day the bruit had disappeared, and has not recurred. Three months later the patient was examined by one of us (de Schweinitz), who found entirely normal conditions.

Pincus (79) reports the spontaneous cure of a traumatic case ten and a half years after the accident; early attempts at compression had, however, been followed by some improvement.

Starkey (16) records the spontaneous cure of an orbital aneurysm of traumatic origin which had persisted for one year. This he attributed to rupture of the aneurysmal sac into the orbital tissues with the formation of a clot which closed the opening in the blood-vessel; subsequently there was gradual absorption of the clot, and cure followed.

The injection of various coagulating fluids in the orbital structures has been properly practically abandoned. It is possible that electrolysis and galvanopuncture may be considered with some hope of success, although they were not employed in any case of the present series.

REPORTER.	REFERENCE.	EYE, SEX, AGE, AND SYMPTOMS.	TREATMENT.	CONDITIONS FOLLOWING TREATMENT.
Karpus.....	Wien. med. Wochenschr., 1900, xiii, S. 357.	<p>O S. F. 69. Patient suddenly developed a sticking pain in the left side of the head and at the same time heard a noise in the left ear. Two days later a slight ptosis of O S; globe sensitive to pressure; diplopia. When seen twenty days after the accident, had severe pain in the head; noise in the left ear; ptosis; slight exophthalmos; a loud blowing rhythmic murmur, systolic in time, heard over both sides of the head, but especially on the left, and most pronounced back of the left auricle. Can be heard several centimeters from the head. Paresis of the abducens and external branches of the oculomotor, no other cranial nerve involvement. Arteriosclerosis of the palpable vessels; hypertrophy of the left ventricle; trace of albumin. No pulsation of the globe and no stasis phenomena at outer or inner angle of eye. O D = <math>\frac{5}{16}</math>; O S <math>\frac{1}{10}</math>.</p> <p>Compression of the left common carotid causes murmur and noise in the ear to disappear.</p>	<p>Ligation and section of the left common carotid. Local anesthesia.</p>	<p>After ligation, murmur and paresis of ocular muscles improved; exophthalmos and pain disappeared. Two days later heart-weakness, right-sided hemiplegia with aphasia. Lobar pneumonia and death six days after ligation.</p> <p>Diag.:—Aneurysm of the internal carotid at the base of the brain; rupture.</p> <p>Following ligation, softening of the left hemisphere of the brain. Arteriosclerosis.</p> <p>Autopsy:—In the left cavernous sinus was found a ruptured sacculated aneurysm of the internal carotid 1 cm. long; in aperture a thrombus 3 cm. long.</p> <p>Basal vessels slightly sclerosed. Left hemisphere softened. Heart muscles show fatty degeneration.</p>
Golowin.....	Zeitschr. f. Augenheilk., 1900, iv, S. 182.	<p>Bilat. F. 19. Spontaneous development. Both upper lids appear swollen; in the middle of upper lids can be seen round, bluish swellings the size of a hazelnut.</p>	<p>Ligation and excision of right superior ophthalmic vein</p>	<p>After first operation the dilated veins on the right side of the face disappeared; vision and fundus remained normal.</p>

(1)

(2\*)

Similar swellings at the internal angles on each side of nose, also at lower orbital margins on cheeks. These swellings are compressible and have a distinct pulsation. Other veins can be followed from the outer angle over the temple to the border of the hair.

Pulsation and size of swellings increased by bending. Stethoscope over the orbital region reveals an aneurysmal murmur. Position and movements normal; no pulsation of globe. Cornea, iris, and disc are normal; possibly slight over-filling of the central vein.

Symptoms more marked on right side.

three weeks after first observation.

Five weeks later, similar operation on the left side.

Three weeks after second operation, no venous swellings on the face. Movements and fundus normal.

G. D. J. Wood.....

Oph. Soc. United Kingdom, vol. xxi, 1901, p. 135.

Bilateral. M. —. Fell from bicycle and struck on head. Unconscious. Hemorrhage from nose. Two weeks later pain in eyes, exophthalmos developed, bruit gradually, ptosis O D; diplopia; falling vision, especially O S. Palpable pulsation, greater in O S. Subjective bruit suggests "exhaust from engine;" objective bruit loud and blowing, heard over whole head, mostly over O S. Incomplete ptosis, greater in O D. Double and almost complete ext. ophthalmoplegia, right sup. obl. alone ext. Fields normal.

O D =  $\frac{6}{8}$ ; O S =  $\frac{6}{8}$ . Retinal veins distended; no hemorrhages.

Bed; spare diet; K. I. Ligation of left common carotid three months after accident, two months after treatment begun.

After two months of medicinal treatment symptoms worse. In O S field restricted with poorly defined eccentric scotoma; disc pale. In O D cornea seemed to be in danger. Ligation immediately stopped bilateral pulsation; mental condition peculiar; speech thick and slurred; irritable and easily excited. Normal mental condition after one week. Ocular movements improved after twenty-four hours. Six weeks after operation: No exophthalmos; faint bruit audible sometimes at night; only muscular defect was par-

## 1901

1901 (Continued).

REPORTER.	REFERENCE.	EYE, SEX, AGE, AND SYMPTOMS.	TREATMENT.	CONDITIONS FOLLOWING TREATMENT.
<p>3 P. Rascalou.....</p> <p>(3)</p>	<p>Th è s è , P a r i s , 1901.</p>	<p>O S. M. 47. Fall and wound of back of neck and head; fracture clavicle and rib. Unconscious. After ten days pain in head, which improved, then became worse; noise in head like "hammer tapping upon an anvil," especially at night; does not prevent sleep. Vision very good. Five to six weeks after accident slight exophthalmos; continuous bruit increased at each beat; visible and palpable pulsation; paralysis of abductens. Bruit was very loud and resembled the "blow of a forge;" disappears with the pulsation on carotid pressure, reappears after removal of the same. Cornea slightly vascular; disc normal; arteries slender; veins dilated and tortuous. Later on developed a mass at inner angle of orbit.</p>	<p>Ocular compression; daily compression of common carotid; iodid. Ligation of left common carotid thirteen months after accident, eleven months after treatment began.</p>	<p>Two months after treatment began O D, V = 0.7; O S, V = 0.6. Edges of disc not well defined. Other symptoms the same. Seven months after treatment began and before ligation all symptoms worse. O S, V = 0.1. Pupil reflex still present. After ligation bruit ceased; pulsation and mass at inner angle present, but less. Diplopia less. Bruit in head lost its intensity. Vision slightly increased as exophthalmos became less.</p>
<p>4</p> <p>(4)</p>				<p>sis of left ext. rectus—convergent squint; right field normal, left field restricted with eccentric scotoma which had become smaller; disc pale and somewhat atrophic; O D = <math>\frac{5}{8}</math>; O S = <math>\frac{3}{8}</math>. Diag.:—Arteriovenous aneurysm of internal carotid in the cavernous sinus.</p>



P. Knapp.....	<p>O D. M. 24. Injured eye with hayfork. Vomited. Since injury, ten weeks before, eye has been proptosed, worse past two weeks. Noise in right ear.</p> <p>Globe proptosed 8 cm.; ocular movements full; fields, color sense, and accommodation normal. Palpable pulsation; loud, blowing, systolic murmur over globe and temple. Compression of carotid abolished murmur and noise in ear. Right pupil 1 mm. less than left, reacted; iris hyperemic; right disc redder than left, arteries normal, veins somewhat full; no pulsation.</p>	<p>Ligation of right common carotid.</p>	<p>After ligation murmur disappeared, exophthalmos less; no abnormal brain phenomena. Seven days later subjective and objective bruit again heard; beginning change in retinal veins.</p> <p>Twelve days after ligation no murmur, exophthalmos as before; almost all the large retinal veins show one or more peculiar bead-like dilatations, in some places resembling string of beads.</p> <p>Eight months after operation exophthalmos greater than before operation; no murmur or pulsation; iris hyperemic; pupil dilated, irregular and almost fixed—explained by pressure upon ciliary ganglion; numerous vitreous opacities; disc hyperemic; retinal arteries normal; numerous fresh and old hemorrhages.</p> <p>Vision = <math>\frac{3}{4}</math> to <math>\frac{1}{2}</math>. Fields slightly contracted; color sense reduced.</p>
(5)	<p>O S. F. 40. Shortly after an attack of coughing developed pain in O S and within twenty minutes a pulsating noise could be heard in head on left side. Swelling and exophthalmos followed in one and a half hours. A few hours later dilatation of pupil. One day later a loud blowing murmur could be heard over the left side of the head, es-</p>	<p>Periodic compression of common carotid began one month after onset. Previous scarification and ex-</p>	<p>Four months later no exophthalmos, pulsation under brow, visible pulsation of carotid. Ten months after onset bruit still present, but not so marked. Eyeball shrunken.</p>
E. O. Belt.....	<p>Arch. of Oph., xxx, 1901, p. 391.</p>		

## 1901 (Continued).

REPORTER.	REFERENCE.	EYE, SEX, AGE, AND SYMPTOMS.	TREATMENT.	CONDITIONS FOLLOWING TREATMENT.
Debayle..... (6)	Annal d'oculist, T. c x x v i ; J a h r e s - b e r i c h t f. O p h . , 1901.	<p>pecially about ear; pupil contracted, cornea clear.</p> <p>Two days later conjunctiva scarified, sensation impaired also on brow. Pulsation developed three days after onset, eye immovable, protrusion straight.</p> <p>Nine days later portion of conjunctiva excised. Ten days later ulceration of cornea with perforation one week later.</p> <p>One month after onset could stop bruit by compression of carotid; previous attempts failed—short, stout neck. Erysipelas of face developed.</p>	<p>cision of portion of conjunctiva.</p>	
A. Barth..... (7)	Centralbl. f. A u g e n .	O. D. M. 5. Blow on right orbit. Symptoms began three weeks after injury.	<p>Ligation of the internal carotid.</p>	<p>After ligation symptoms gradually disappeared. Died one month later from rupture of aneurysm of the carotid near the aorta.</p> <p>Autopsy showed a communication between the int. carotid and the cavernous sinus.</p> <p>Microscopic examination showed a peculiar endarteritis characterized by hyperplasia of the endothelium corresponding neither to the syphilitic nor atheromatous type.</p>

alysis barely noticeable. Regarded as cured.

Visible and palpable pulsation; systolic murmur heard over whole skull and over O D, which disappeared upon compression of right common carotid. Thrill over inner angle and carotid. Impaired outward rotation. Retinal veins full.

Died five days after the operation.  
Autopsy showed marked blood infiltration of the cavernous sinus. The wall of the internal carotid was thin, but no rupture was found. No abnormalities in the orbit.

Ligation of the left common carotid four days later.

Contemplates an orbital operation and ligation.

After one month's palliative treatment pain diminished and finally disappeared; retinal hemorrhages absorbed; vision improved to  $\frac{2}{3}$ ; diplopia disappeared.  
Subsequently headaches and diplopia returned.  
Diag.:—Rupture of left carotid artery in the cavernous sinus, produced by contrecoup.

Bandage, leeches, analgesics, galvanic current.

O S. F. 33. While vomiting during menstruation suddenly developed severe pain in the left side of the head, and left pulsating exophthalmos developed.  
O D. F. 26. Shortly after delivery perceived a snap in the head, associated with vertigo and loss of consciousness. Developed pulsating exophthalmos. Had a transient albuminuria. Vision between 0.2 and 0.8.  
O S. F. 30. Blow from point of umbrella on right eyebrow. Not unconscious. Hemorrhage from mouth and nose. From the latter repeated hemorrhages for two months came from nasopharynx and left nasal fossa. Vomiting. Intense pulsating pain over whole head, later localized on left side; required morphin for sleep. At first continuous, then intermittent. Immediately after accident heard a noise in left ear. On third day noticed diplopia, swelling, and slight exophthalmos of O S.

Heilk.,  
25, 1901, S.  
255.

J a h r e s -  
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f. Oph.,  
1901. Orig.  
not avail-  
able.

J a h r e s -  
b e r i c h t  
f. Oph.,  
1901. Orig.  
not avail-  
able.

Clin. Ocul.,  
Palermo,  
1901, 611.

(8)

(9)

(10)

Calderaro.....

1901 (Continued).

REPORTER.	REFERENCE.	EYE, SEX, AGE, AND SYMPTOMS.	TREATMENT.	CONDITIONS FOLLOWING TREATMENT.
<p>Siegrist.....</p> <p>(11)</p>	<p>A r c h . f . Oph., 1, 3, 1901, S. 511.</p>	<p>O S. Lids swollen, venous arch extending from inner to outer angle of eye. Exophthalmos 12 mm. with internal deviation of 10°; palpable pulsation; rhythmic murmur heard over whole head, left jugular vein below mastoid and over left common carotid. Compression of carotid abolishes murmur and reduces congestion and exophthalmos. Can move globe in all directions. Field uniformly constricted. Pupil same size as right, but has only slight reaction to light and accommodation. Retinal veins full, tortuous, and slightly pulsating. Vision = <math>\frac{1}{2}</math>. Vision of O D = 1. Retinal hemorrhages O S.</p>	<p>Ligation of internal and external carotid on left side.</p>	<p>Immediately upon ligation of internal carotid murmur in head disappeared. Twenty-four hours later, vision restricted. Forty-eight hours later, retinal veins very full and tortuous, arteries slender; pallor of macular region. One week later, counts fingers at 10 cm. in temporal field. Fundus examination showed picture of embolism of central artery.</p>

O S pupil slightly wider than the right, direct and indirect light reflex good. Disc edges sharp, pale; retinal veins dilated and tortuous, arteries slightly contracted. Heart showed dilatation right side with systolic murmur over midsternum.

Thirteen days following ligation suddenly fell to floor, had a paralysis of right side, aphasia. After four hours this condition disappeared.

One month after ligation, slight exophthalmos, can hear slight murmur over skull, subjective murmur at night.

Five months after ligation: disc atrophic, fine punctate pigmentation over fundus; beginning sclerosis of choroidal vessels.

One and a half years after ligation, extensive sclerosis of choroidal vessels and punctate pigmentation in macular region. Eye blind.

Diag.:—Rupture of carotid in cavernous sinus.

Thinks embolism due to a clot in the aneurysm or to ascending thrombosis of the internal carotid.

J a h r e s -  
b e r i c h t  
f. Oph.,  
1901; An-  
nali di Ot-  
tal., Nap.,  
1900, xxix;  
1901, fasc.  
2, xxx.

O D, F. 44. Exophthalmic goiter since twenty-two years old. Trauma of head. Exophthalmos increased. Chemosis and ptosis. Pupil fixed, corneal infiltration, iritis. After three weeks severe pulsation of the globe and noise in ear. Retinal arteries contracted. Visual acuity much lowered by glaucoma.

Iodin internally. Repeated and prolonged compression of the right common carotid.

After ten months regarded as cured. Exophthalmos much reduced, no pulsation. Barely audible faint rhythmic murmur. Diag.:—Rupture of the internal carotid in the cavernous sinus.

(12)

Bossalino.....

(13)

1901 (Continued).

REPORTER.	REFERENCE.	EYE, SEX, AGE, AND SYMPTOMS.	TREATMENT.	CONDITIONS FOLLOWING TREATMENT.
W. Erculentz.....	Abstracts Oph. Rec- ord, x, p. 1901, p. 646. Cen- tralbl. f. A u g e n - h e i l k . , 1901, S. 374.	O. D. F. 39. Globe pulsated; proptosed. No subjective or objective bruit. Vision normal; fundus normal.		Death from carcinoma of the stomach. Posterior wall of orbit absent so that space occupied by the globe formed with the middle fossa of the skull one large cavity divided by a membrane representing the dura mater and the periotestum of the orbit, which acted as a support to the orbital contents. The frontal lobe of the brain projected into the orbital cavity, forcing the globe forward and commu- nicating its pulsation directly to the globe. This case probably the same as the one credited to Uhthoff and referred to by Lagrange. Diag.:—Pulsating exophthalmos produced by orbital encephalocele.
(14*) Gayet.....	Soc. de chir. de Lyon, 1901, Juin et H o u i l - lon, Thèse de Nancy, 1903.	— F. 16. Penetrating wound of the orbit from knitting-needle. There imme- diately followed exophthalmos, periorbital veins distended, thrill. Continuous bruit with reinforcement heard over the orbito- frontal region.	Digital compres- sion of the com- mon carotid. Ice and scarifi- cation of the superficial ete- ma.	Subsequently thrill disappeared, pain diminished. Fundus showed slight venous stasis and edema. July 11th, 2 weeks after first pre- sentation to the society, the spon- taneous improvement continued. Diag.:—Arteriovenous aneurysm of the orbit.

<p>H. M. Starkey.....</p>	<p>Oph. Rec-ord, xi, 1902, p. 558.</p>	<p>— M. —. This patient shown one year ago, and then had a soft compressible tumor up and in from the globe; pulsation of orbital contents and marked bruit; exophthalmos. Several weeks after this patient was seized with severe pain, accompanied by greater protrusion, swelling and redness of lids, inability to move eye. This persisted about three days and then gradually subsided; swelling gradually diminished, pulsation and noise in the head ceased.</p>	<p>None stated.</p>	<p>Diag.:—Pulsating exophthalmos the result of basal fracture. Eye in normal position; no tumor, pulsation or bruit. Optic atrophy. V = <math>\frac{2}{3}</math>°. Observer regards it as a spontaneous cure of an orbital aneurysm after persistence of one year. Explained recovery by a rupture of the aneurysmal sac into the orbital tissues; blood thus thrown out formed a clot in such a way as to close the opening in the blood-current; gradual absorption of the clot with resulting cure.</p>
<p>Mariani.....</p>	<p>Corriere sanit., 1902, xxiii, 133.</p>	<p>Bilat. M. 60. While straining at stool, suddenly developed intense pain in O S with immediate injection of conjunctiva. When case came under observation O S had eversion of lower lid, exophthalmos with displacement out and down. At the upper and inner portion of orbit a fusiform tumor the size of a hazelnut, which showed a distinct palpable pulsation. On the lid and over above swelling a soft continuous murmur was heard, murmur accentuated with cardiac systole. Also heard in temporal and frontal regions of both sides. Cornea slightly opaque; pupil dilated and did not react to light. Globe immovable. O D: slight exophthalmos, less</p>	<p>Restricted diet; ice-cap to head; 2 grams of ergotin daily; daily compression of left common carotid for five minutes.</p>	<p>Following compression, O S showed immediate improvement, but O D became worse. One and a half months after accident condition notably improved, especially in O S, but blindness in this eye persisted. Two weeks later, on awakening in the morning discovered he was also blind in right eye, and that the noise in head had disappeared. No light reaction in pupil. No murmur. O S showed optic atrophy. O D veins turgid. Blindness in O D attributed to</p>

1902 (Continued).

REPORTER.	REFERENCE.	EYE, SEX, AGE, AND SYMPTOMS.	TREATMENT.	CONDITIONS FOLLOWING TREATMENT.
(17) W. E. Lambert.....	Arch. of Oph., xxxi, 1902, p. 281.	<p>edema. Pupil noted. Pupil con- tracted and reacted to light. Fundus, O S: Arteries almost invisible, retina similar to high degree of anemia. O D: Retinal veins dilated and tortuous. Hearing and taste impaired on left side; smell normal on both. O S: blind. Compression of carotid caused disappearance of murmur on left side.</p> <p>O D. M. 20. Four years ago struck in eye with a potato, followed immediately by swelling, which never completely subsided. Two years later developed a swelling which extended upward to forehead from the inner margin of the orbit. Exophthalmos and pulsation. Bruit heard in neck. Lower lid everted and a mass of orbital tissue projected from the eyeball and inner surface of the lower lid near the inner canthus. Severe hemorrhage from this mass a few days before ligation. Retinal veins engorged. V = <math>\frac{20}{40}</math>.</p>	<p>Ligation of the internal and ex- ternal carotids with ligation of the lingual and facial branches (Dr. Wyeth). Extirpation of orbital mass from the orbit (Dr. Lambert).</p>	<p>acute dilatation of the right cavernous sinus with pressure of the optic nerve at its entrance into foramen. Diag.:—Spontaneous rupture of the left internal carotid in the cavernous sinus.</p> <p>After ligation exophthalmos somewhat subsided, but had repeated hemorrhages from orbital mass. After extirpation—three weeks— no recurrence of hemorrhages, and patient could almost close lids. Diag.:—Arteriovenous aneu- rysm due to rupture of the inter- nal carotid in the cavernous sinus.</p>
(18) Wiemuth.....	Deutsche med. Wo- chenschr., 1902, No. 24, S. 182.	<p>O S. —. —. Shot in right temple. Immediately after injury had paralysis of first trigeminal branch on the right side. This followed by neuro-paralytic keratitis. Globe enucleated. Six months after injury pulsating exophthalmos developed in the left eye. Noise in head.</p>	<p>Enucleation of O D. Ligation of the right com- mon carotid. Section of right common car- otid and ligation of its branches.</p>	<p>After first ligation symptoms recurred in three months with pulsation above ligation. After second operation recurrence in one month. Vision reduced. Abducens paralysis. Compression had no effect. Vision lost.</p>



(19)	Reynier.....	Rec. d'oph., 1902, p. 257.	O D. F. 41. Fell and struck head, resulting in a basal fracture. Subsequently developed exophthalmos and bruit. Bruit disappeared by compression of the right carotid. Paralysis of the external branches of the oculomotor. Diminution of vision and dilatation of the retinal veins.	Compression of left common carotid, daily for one hour. Ligation of the right common carotid. Intra-muscular injections of serum gelatin, at first in doses of 5 c.c. Subsequently dosage increased to 100 and 200 c.c. upon suggestion of Paulesco.	Observer thinks that the circulation to the site of the injury in the carotid was re-established through the vertebral artery. After ligation, symptoms disappeared for eighteen days, then recurred. After a series of gelatin injections symptoms disappeared. Slight reduction in vision. Diag.:—Arteriovenous aneurysm of the internal carotid in the cavernous sinus.
(20)	Rohmer.....	Reported by Houillon, Thèse de Nancy, 1903.	O D. M. 10. Crushing injury of head. Unconscious. Hemorrhage from the mouth, nose, and ears, also vomited blood. After five days noticed he was deaf on the right side. Six weeks after the accident he suddenly developed an exophthalmos of the right eye. Examination showed complete right-sided facial paralysis; venous distention of right anterior part of head. Palpable pulsation. Intense murmur over eye and in whole temporal region, which disappears upon carotid pressure. Absolute deafness on right side. Eye not movable. Tension normal. Disc normal.	Ligation of right common carotid six weeks after injury.	Following ligation the murmur and pulsation disappeared; exophthalmos diminished. Three weeks after ligation, exophthalmos had completely disappeared. Deafness and facial paralysis persist. Diag.:—Arteriovenous aneurysm at entrance of carotid in cavernous sinus. Basal fracture.
(21)	Houillon.....	Thèse de Nancy, 1903.	O D. F. 27. Fell on pavement and struck right side of head. Consciousness not fully regained for fifteen days. No hemorrhage	Iodin gr. i a day. Ligation of right common carotid	Following first ligation, murmur disappeared and exophthalmos less; pallor of right side of face.

1902 (Continued).

REPORTER.	REFERENCE.	EYE, SEX, AGE, AND SYMPTOMS.	TREATMENT.	CONDITIONS FOLLOWING TREATMENT.
Aubaret .....	Rev. gén. d'Opht., 1902, 282.	from nose or ears, but vomited blood. Immediately after accident O D became prominent. Complained of severe pain in head after patient regained consciousness. Vision decreased. Eight weeks after accident, when patient first seen, had an exophthalmos of O D. Eleven weeks after accident, exophthalmos, marked palpable pulsation; intense murmur perceptible all over skull. Pulsation and murmur disappear upon carotid compression, while exophthalmos and congestion become less. Vision = o. Intense congestion of papilla, which is edematous, choked disc. Palpable pulsation in superior internal angle of orbit. Noise in head developed between the eighth and eleventh week after the accident.	tid with catgut about eleven weeks after the accident. Six weeks later right common carotid re-ligated. Rest in bed, injections of serum-gelatin. Four weeks after last ligation, the right internal carotid was ligated with silk.	Recurrence in two to three weeks. Observer believed catgut was absorbed before obliteration of the artery. Gelatin injections without results. Following last ligation no improvement. Day following patient states that murmur and pulsation have rather increased. Two weeks after last ligation no notable improvement.
(22)			None stated.	Diag.:—Arteriovenous aneurysm of the orbit.
Armaignac .....	In discussion of the case	In the discussion of the above case Armaignac referred to a "similar case" that had come	Ligation of both carotids.	Symptoms recurred after first ligation. Death. Autopsy
(23)				

reported by  
Aubaret.  
Rev. gén.  
d'Opht.,  
1902, 282.

(24\*)

failed to show any trace of  
aneurysm.

## 1903

C. S. Bull.....

T r a n s .  
A m e r .  
Oph. Soc.,  
1903, x,  
p. 38.

O S. M. 29. Struck on top of head with a bottle. Not unconscious. Next morning a roaring noise on left side of head that extended over whole skull. Two days after accident O S began to protrude and signs of venous stasis. No pain. First observation one month after injury, when O S was proptosed straight forward. Visible and palpable pulsation. A loud bruit could be heard over the left eye, temple, and forehead, also on right side of head, occiput, and vertex. No impairment of ocular movements. Fields normal. Vision of each eye =  $\frac{2}{3}$ . Tension normal. O S fundus: Retinal veins engorged, pulsation; no hemorrhages. One week later could be noted a dilated vein at the junction of the middle and inner third of the supraorbital margin. Just beneath this a distinct fissure in the frontal bone could be traced backward along the roof of the orbit. Slight protrusion of O D.

Ligation of left common carotid seven weeks after accident. (Dr. F. W. Murray.)

After ligation, pulsation, thrill, and bruit ceased and never returned. Eleven months later slight exophthalmos, no bruit or pulsation. O S slightly divergent for distance. O D =  $\frac{2}{3}$ ; O S =  $\frac{2}{3}$ . Retinal veins of each eye engorged and tortuous and throughout retina the remains of numerous hemorrhages. Diag.:—Fracture of skull; arteriovenous aneurysm posterior to orbit, possibly involving O D.

Bertram.....

Klin. Monatsbl. f. Augenheilk.,

(25)

Digital compression of the carotid. Ligation of right

Compression failed. Following ligation exophthalmos receded and for three or four months eye improved, then throbbing

## 1903 (Continued).

REPORTER.	REFERENCE.	EYE, SEX, AGE, AND SYMPTOMS.	TREATMENT.	CONDITIONS FOLLOWING TREATMENT.
(26)	1903, xli, 2, S. 294.	and other symptoms of pulsating exophthalmos.	common carotid.	recurred. Melancholia and suicide. Diag.:—Basal fracture. Autopsy refused.
J. H. Thierry.....	J a h r e s - bericht f. Oph., 1903; Archiv für Chir., 68, 5, 1903, 577.	O S. M. 26. Blow on right temple. Taken to hospital unconscious with symptoms of fracture of skull. Two months later deafness of right ear, diplopia (paralysis of left abductens), paralysis of right facial. Left pupil contracted; right dilated. Vision, fields, fundus, and otoscopic findings normal. After two weeks symptoms improved under iodid and strychnin. After one and a half years pulsating exophthalmos of O S developed. Globe protruded and divergent; movements limited, but could not accurately determine the particular nerve involvement. Hearing on right side good, on left lost. Left pupil dilated. Retinal veins in O S dilated and pulsate feebly. Compression of carotid caused pulsation and bruit to disappear; exophthalmos receded. Vision = $\frac{1}{10}$ .	Iodid and strychnin, before pulsating exophthalmos developed. Ligation of left common and left internal carotid.	Following ligation pulsation and bruit disappeared, exophthalmos receded. Fourteen days later gradually increasing paralysis of the right arm with impaired sensation. Delirium and psychic disturbance. Patient subsequently improved, and four years after accident he returned to work. At this time eye still showed some proptosis, but no pulsation. Movements full. Slight noise in ear. Fundus normal. V = $\frac{5}{7.5}$ .
(27)	Ibid.	Bilat. M. 49. Fell and was unconscious for five days. Basal fracture. After two months only trochlear is functioning on right side. O D = $\frac{5}{10}$ . O S shows paralysis of external rectus, disc pale. V = $\frac{5}{10}$ . Each eye slightly proptosed; no	Iodid. Digital compression refused.	Improvement of the oculomotor paralysis on the right side. Could not determine whether involvement of external recti due to compression by aneurysm or to traumatic nerve lesion.

Diag.:—Rupture of internal carotid in the cavernous sinus.

distinct pulsation. Over whole skull a feeble bruit, most distinct over left upper lid. Dilated veins at root of nose, more marked on right side. O D pupil dilated, veins in right fundus dilated and feebly pulsating. Compression of right carotid caused disappearance of murmur and distention of veins became less. Hearing not impaired. Six weeks later movements of O D good, but had a bilateral paralysis of the external recti. Left eye pulsating. Six months later no change except contraction of external recti.

—, Young man. Subject to epilepsy and no history of trauma other than that occurring during attacks. Exophthalmos, pulsation, no murmur. Pulsation disappeared upon carotid pressure. No fundus changes. Slight ptosis and posterior synechiæ from chronic iritis.

O S. M. 28. Fell and was unconscious two hours. No hemorrhages, vomiting, headache, or paralysis. The only symptoms noted were proptosis of O S and noise in head. Subsequently O S swollen, marked dilated vessels at inner angle of orbit, along root of nose; less at outer angle and in upper lid. Over vessels at inner angle the superimposed finger detected a thrill, increased at the time of pulsation. Exophthalmos. Visible and palpable pulsation. Over the whole skull, but especially the left side and in the neck, could be heard a loud metallic murmur, synchronous with systole. Not affected by stooping, but dis-

(28)

Pröbsting.....

M ü n c h .  
med. Wochenschr.,  
1903, S.  
576.

(29)

W. Sobernheim.....

I n a u g .  
Dissert.  
Freiburg,  
1903.

None stated.

Not given.

Ligation of the left internal carotid four months after accident.

Two weeks after ligation no cerebral disturbance had developed. Murmur, noise in head, thrill, and pulsation disappeared. Exophthalmos and distention of veins became less. Pupil fixed.

Five weeks after ligation O D  $\frac{5}{8}$ ; O S  $\frac{5}{8}$ . Still has distended veins at angles of eye, but no pulsation felt over these. No visible or palpable pulsation of globe unless eye pressed backward, when slight pulsation could be felt. Free ocular

## 1903 (Continued).

REPORTER.	REFERENCE.	EYE, SEX, AGE, AND SYMPTOMS.	TREATMENT.	CONDITIONS FOLLOWING TREATMENT.
		<p>appearing upon carotid pressure. Marked pulsation of left carotid, right less. Paresis of left external rectus. O S, cornea, lens, and vitreous clear. Disc normal, retinal veins full and tortuous, no distinct pulsation. No hemorrhages. Pupil contracted and fixed. Iris hyperemic. No <i>bruit de piaulement</i>. O D normal. Ears negative. O D = <math>\frac{5}{8}</math>; O S <math>\frac{1}{5}</math>. No decided changes of internal organs.</p>		<p>movements. Corneal sensation impaired, but structure was clear. Pupil 6 mm., eccentric down and out; feeble reaction of inner part of iris to direct and indirect light, also to convergence. Opacities in upper and outer quadrant of lens; vitreous clear; disc normal, veins full and tortuous; slight macular changes.</p> <p>Two and a half months later, O D <math>\frac{7}{8}</math>; O S <math>\frac{8}{8}</math>. Partial pupillary reactions; iris hyperemic. Cataract showed no change. Macula intact; no subjective symptoms. No murmur except in temple, where could be heard a prolonged, very high, mewing murmur, accentuated with the pulse and then fading away. No pulsation of neck vessels.</p> <p>Diag.:—Basal fracture with rupture of the internal carotid in the cavernous sinus.</p>
(30)		<p>O D. M. 54. Fell and struck right brow. Vomited, not unconscious. Three days later diplopia and cast in O D. Two to</p>	<p>Ligation of right common carotid about one</p>	<p>Following ligation, pulsation, subjective and objective bruit ceased.</p>
W. J. Collins.....	Lancet, 1903, p. 1090.			

(31) H. V. Würdemann ...	<p>four weeks later proptosis of O D, pulsation in region of upper lid. Loud systolic bruit heard over right temporal and frontal regions. Globe displaced out and down. Complained of blowing noise in the head. Media and fundus normal. Vision = <math>\frac{5}{9}</math>. O S normal.</p> <p>O D. F. 40. While sitting on a window ledge washing windows, patient felt something snap in her head, became dizzy, and vomited. Shortly after noticed that O D protruded and had diplopia. Had headache and rushing noise in the head. Two years later, when patient came under observation: O D = <math>\frac{5}{24}</math>; O S = <math>\frac{5}{6}</math>. Visual fields large with small paracentral scotoma in O D. O D for distance 10° of exophoria, 10° right hyperphoria. Exophthalmos of O D. Bending caused an increase in the dizziness and noise in head, while the vision became less. Could reduce proptosis by pressure, but it returned when pressure removed. Bruit could be distinguished by the touch and the roaring sound by the stethoscope was heard perceptibly later than the ventricular movements of the heart. Compression of the carotid stopped the bruit and reduced the exophthalmos. Retinal veins of O D dilated and tortuous, while the arteries were relatively larger than O S.</p>	<p>month after accident.</p> <p>Ligation of external and common carotid on right side two years after accident and one day after case came under observation.</p>	<p>One month later, proptosis still present; on several occasions a temporary return of bruit. Three months later, no pulsation or bruit, some ectropion of lower lid remained.</p> <p>Diag.:—Intracranial aneurysm.</p> <p>From time of operation bruit and subjective noises disappeared. Exophthalmos and ocular congestion less.</p> <p>Seven weeks after ligation, O D = <math>\frac{5}{6}</math>; O S = <math>\frac{5}{6}</math>. No diplopia, fields normal and no scotoma. Retinal veins on affected side fuller and more tortuous than on left side. No exophthalmos, subjective noise in head, or headaches.</p>
(32) G. Hartridge.....	<p>A n a l s of Oph., 1903, xii, p. 235.</p> <p>O S. F. 10. Tine of hay-fork entered left side of nose, slightly below and to inner side of internal canthus. Soon after O S became proptosed and turned inward.</p>	<p>None stated.</p>	

1903 (Continued).

REPORTER.	REFERENCE.	EYE, SEX, AGE, AND SYMPTOMS.	TREATMENT.	CONDITIONS FOLLOWING TREATMENT.
J. H. Neff..... (33)	I n a u g. D i s s e r t. H e i d e l - b e r g , 1903.	O D = $\frac{6}{8}$ ; O S $\frac{6}{8}$ . Exophthalmos, loud bruit of blowing character heard over left side of head. Abducens paralysis. O D, disc normal. O S, disc hyperemic, retinal veins full and tortuous. One year later O D = $\frac{6}{8}$ ; O S = $\frac{6}{8}$ . Bruit had altered and was now of a whistling character.	Ligation of right common car- otid, two weeks after accident.	When last observed, four years after ligation, there was almost complete disappearance of the exophthalmos, no diplopia, no objective bruit. At times head- aches and slight subjective bruit. Diag.:—Arteriovenous aneurysm of the internal carotid in the cavernous sinus.
J. H. Neff..... (34)	Ibid.	Bilat. M. 46. Fell and struck left side of head. Hemorrhage from the mouth, nose, and left ear. Unconscious one day. Six weeks later proptosis of each eye; sub- jective bruit; diplopia; vision reduced in	Daily compres- sion of left common car- otid.	Compression without results. Patient died eleven months after accident. Autopsy: Thrombosis of cavern- ous sinus and both inter-



each eye. Impaired hearing on left side, the right impaired before accident. Fundus indistinctly seen; disc of normal tint, veins dilated and tortuous; retinal arteries normal. Had a bilateral, intermittent, synchronous, blowing murmur, not of great intensity. Slight alternating divergent strabismus. Carotid pressure without marked influence on exophthalmos.

$OD = \frac{5}{7.5}$ ;  $OS = \frac{5}{7.5}$ .

Eight months later  $OS$  became inflamed and showed decided fundus changes.  $OS =$  fingers at 2 m.

Ten months after accident exophthalmos in each eye less. Pallor of disc in  $OD$ .  $OS$ , disc pale, vascular changes with retinal hemorrhages and whitish spots in fundus. No murmur heard.

M ü n c h .  
med. Wochenschr.,  
1903, S.  
1315 u.  
1939.

Bilat. M. 39. Blow on the head with leg of a chair. Unconscious three months. Hemorrhage from left ear and nose, the latter repeated during subsequent two years. About three months later proptosis of both eyes. Next one and one-half years myosis, no light reaction, and vision almost lost, thought by a number of observers to be due to optic atrophy. About two and one-half years later developed an enormous swelling (venous ectasia) on both sides under eyebrows and on left frontal region. Tortuous vessels ran to vertex, also to temporal region. Over these masses a distinct thrill, which could be heard with stethoscope. Pulsation of globes. Limitation of motion on both

Local compression by Es-march band-  
age. Ligation of left common carotid followed fourteen days later by ligation of the superior ophthalmic vein in the orbit and extirpation of the venous ectasia.

No result following local compression. Following the operations, observer reports a cure. Diag.:—Rupture of carotid in the cavernous sinus.

cavernous (anterior and posterior) sinuses and of the left superior and inferior ophthalmic veins and their branches. Retinal hemorrhages. No certain direct communication between the internal carotid and the cavernous sinus.

1903 (Continued).

REPORTER.	REFERENCE.	EYE, SEX, AGE, AND SYMPTOMS.	TREATMENT.	CONDITIONS FOLLOWING TREATMENT.
(36) Axenfeld.....	M ü n c h . med. Wochenschr., 1903, S. 576.	sides due to bilateral abducens paralysis. Palpable fissure in bone extending from root of nose through frontoparietal region.		
(37) Coppez.....	Klin. Monatsbl. f. Augenheilk., 1903, xli, 1, S. 289.	O S. —. Result of a fall. Eye showed symptoms of a pulsating exophthalmos. Partial iridoplegia and beginning cataractous changes in lens.	Ligation of left common carotid.	Improved.
(38*) Coppez.....	Ibid.	O D, M. 17. Squeeze of the head. Unconscious; hemorrhage from the nose and ears. Noise and pain in the head. Aneurysmal dilatation and pulsation of the supraorbital artery. O D exophthalmos; a blowing murmur can be heard over the temporal region which disappeared upon carotid pressure. Paresis of right external rectus. Vision = fingers at 1½ meters; disc and retina hyperemic. Inequality of radial pulse on the two sides, both in time and volume, owing to innominate aneurysm.	Not stated.	Diag.:—Aneurysm of the internal carotid.
(39*) Coppez.....	Ibid.	O S. —. 8. Fall and wound of orbit with shears. No hemorrhage. Symptoms of meningitis within twenty-four hours. Left eye became blind the third day after the accident. One week after the accident venous stasis of O S with exophthalmos and paralysis of abducens. Systolic murmur heard in temporal region. Disc white.	Not stated.	Diag.:—Probable arteriovenous aneurysm of the internal carotid.

A. Kretz.....

M ü n c h.  
med. Wochenschr.,  
1903, No.  
37, S. 1725.

O D. F. 28. Condition developed insidiously, but positive as to exophthalmos for three years. At that time lids were swollen, had pain in the head of varying intensity; vertigo; frequent hemorrhages from the right nostril that increased in volume and frequency.

Now only a suggestion of edema in the lids. Globe pushed out and down, but could be replaced. No spontaneous pulsation, but this could be developed by gentle pressure. Finger felt a pulsating mass between upper orbital wall and globe. At no time a definite noise in the head, but there was a questionable buzzing in the right ear. Above upper tarsus a slightly pulsating mass. A pulsating mass between auricle, mastoid process, and inferior maxilla which produced pulsation of the lobe of the ear. Pulsation of the right carotid. Vision = 0.5 with + 1. Fundus arteries, ordinarily invisible, were dilated and tortuous; a tangled mass of dilated and tortuous vessels between disc and macula; no pulsation. Disc indistinctly bordered. Fields and ocular movements normal. Compression of the right carotid had no effect upon the orbital mass or pulsation. Had a right hypertrophic rhinitis.

Ligation of the right common carotid.

After ligation, no pulsation of orbital mass or lobe of ear. One month later, no pulsation, orbital swelling no smaller; fundus and vision the same.

Diag.:—Cirroid aneurysm of the right external carotid, ophthalmic artery, and central artery of the retina.

Ligation of the right common carotid.

O D. M. 32. Gunshot—fowling-piece—wound of head. Not known whether he became unconscious. Hemorrhage from nose and left ear; vomited; pain in head and orbit. Few hours after accident no

Oph. Review, 1904, xxiii, p. 135.

C. H. Usher.....

1904

One day after ligation no bruit or pulsation; restless. Two days after ligation taken with dyspnea and died in twenty minutes.

Ligation of external and internal carotids (Dr. Reid).

Oph. Review, 1904, xxiii, p. 135.

1904 (Continued).

REPORTER.	REFERENCE.	EYE, SEX, AGE, AND SYMPTOMS.	TREATMENT.	CONDITIONS FOLLOWING TREATMENT.
<p>C. H. Usher.....</p> <p>(41)</p>	<p>Ibid.</p>	<p>light perception in O D; pupil semidilated, no light reflex; cornea hazy; only slight movements of globe. Small wound in upper and inner part of upper eyelid. Proptosis; palpable pulsation. One day later heard noise in head like a waterfall or steam-engine. Visible and palpable pulsation of globe; pulsation on right side of neck. Subjective bruit diminished by carotid pressure. Two days after accident a loud blowing systolic murmur heard over each eye and temple. O S normal.</p>	<p>Ligation of external and internal carotids.</p>	<p>Autopsy: Two rents in the wall of the internal carotid that communicated with sinus. No fracture, aneurysm of internal carotid or ophthalmic artery; no tumor or foreign body. On removing roof of orbit found bulging of the peristomium at the internal angular process of the frontal bone, incised and found swelling of the ocular muscles; much distention and tortuosity of the ophthalmic veins; two extravasations of blood, one on the ocular side of the superior oblique and the internal rectus anteriorly and the other on the orbital aspect of the external rectus posteriorly. A minute aperture in the superior ophthalmic vein lay in the center of the first extravasation.</p>
		<p>O S. M. 57. Upon arising in the morning noted a stiffness of O S as if the eye were bulging. No history of trauma; no pain; sight good. No history of syphilis, gout, rheumatism or eye affections. Within a week noted a noise in head similar to "breathing with mouth open." About six weeks later, when he came under</p>		<p>Five weeks after ligation: O D=<math>\frac{5}{8}</math>; O S=<math>\frac{5}{8}</math>. Pupils equal and react to light and accommodation. Proptosis less; ocular movements full; no pulsation felt on pressure; faint bruit heard over globe, but not elsewhere. No subjective bruit since ligation.</p>

observation, had exophthalmos, pulsation; could hear over left eye a loud blowing murmur synchronous with the pulse and widely conducted by bones of the skull. Also heard in right temple. Movements impaired in all directions, but especially outward.

O D =  $\frac{5}{6}$ ; O S  $\frac{1}{2}$ . Left disc paler than right and retinal veins in left eye larger than right; no pulsation of vessels in fundus; no gross changes. Heart action irregular with systolic murmur at apex; accentuation of second sound at pulmonary area, at inner end of left fifth interspace a reduplication of first sound. Radial arteries rigid. Lungs and urine negative. Hearing: watch on contact with right ear, left not at all.

O S. F. 4. Fell and struck left side of face, causing bruising and swelling of lids. Unconscious ten or fifteen minutes. Bleeding from nose; nausea but no vomiting. Two months later, when case came under observation, O S proptosed; ocular movements full. Pulsation of O S on pressure. A loud bruit synchronous with the pulse could be heard over O S and left temple; also over O D. Bruit ceases upon carotid pressure. Recognized objects as coins, etc. Pupils equal, O S being sluggish.

O S: media clear; pulsation of all large retinal arteries, veins distended and tortuous. Right fundus normal. Had subjective bruit.

Ligation of left common carotid.

At time ligation applied no change in fundus vessels, but after operation no pulsation in arteries. One hour after operation bruit heard over eye, proptosis less. Five days after ligation no pulsation, faint bruit still audible, exophthalmos less. Five months after operation, slight exophthalmos; movements full but in convergence O S makes but little attempt to move inward. Cornea hazy, but no ulceration. No pulsation or bruit. Pupil dilated and no reaction to light or accommodation. Tension normal. Hearing normal. O D negative.

Six years after ligation; slight proptosis; movements full; no pulsation, subjective or objective bruit. Fundus and fields normal. Sensation of cornea intact. O D =  $\frac{5}{6}$ ; O S =  $\frac{5}{6}$ . Evidences of arteriosclerosis in many vessels.

Ibid.

C. H. Usher.....

1904 (Continued).

REPORTER.	REFERENCE.	EYE, SEX, AGE, AND SYMPTOMS.	TREATMENT.	CONDITIONS FOLLOWING TREATMENT.
Van Duyse.....	A r c h i v . d' O p h . , 1904, xxiv, 288. La- g r a n g e , T r a i t é d e s T u m e u r s d e l' O e i l , e t c . , v o l . i i , p . 287.	O D. M. 22. Trauma to orbit at four years. No syphilis, rheumatism, or alcoholism. Proptosis of O D, noted three years before case came under observation, was of gradual development and associated with pain in the frontal region and vertex. When case first seen, there was proptosis of O D, which was displaced out and down; objective bruit and pulsation at internal angle. No pain. Pupils and extraocular muscles normal. Bruit diminished by carotid pressure. O D = $\frac{3}{3}$ , retinal veins full. O S = $\frac{1}{2}$ , optic atrophy. Twenty months later a tumor detected in right nasal fossa. Two years after first observation, exophthalmos as above, cornea 3 cm. in front of outer edge of orbit; axis of regard straight. Subjective bruit and constant objective bruit heard best at inner angle; below inner angle a pulsating mass. Protrusion in median frontal region and region of frontal sinus. O D = $\frac{3}{3}$ . Choked disc. O S: Divergent, blind, optic atrophy. Hearing abolished on left side, diminished on right. Loss of smell on right side.	G e l a t i n i n j e c t i o n s . C o m p r e s s i o n o f c a r o t i d . L i g a t i o n o f r i g h t c o m m o n c a r o t i d t h r e e y e a r s a f t e r f i r s t o b s e r v a t i o n . L i g a t i o n o f l e f t c o m m o n c a r o t i d s i x t e e n m o n t h s a f t e r l i g a t i o n o f r i g h t .	I n j e c t i o n s , c o m p r e s s i o n , a n d f i r s t l i g a t i o n w i t h o u t r e s u l t s . S e c o n d l i g a t i o n f o l l o w e d b y d i s a p p e a r a n c e o f p u l s a t i o n a n d o b j e c t i v e b r u i t . D i e d o n e y e a r a f t e r t h e l a s t o p e r a t i o n . W h e n f i r s t o b s e r v e d , c o n d i t i o n r e g a r d e d a s a n a n e u r y s m o f t h e o p h t h a l m i c a r t e r y . A f t e r l e s i o n i n r i g h t n a s a l f o s s a d i s c o v e r e d i t w a s t h o u g h t t o b e a n a n e u r y s m o f t h e p o s t e r i o r e t h m o i d a l a r t e r y . A u t o p s y s h o w e d a f i b r o s a r c o m a — p s e u d o - c y s t i c — o f e t h m o i d a l o r i g i n .
(44)	O p h . S o c . U . K . , 1904, xxiv, p. 190.	O S. F. 58. Following a fall on the head developed abducens paralysis. Four months later said to have had a "stroke."	H e a t a n d p o t a s s i u m i o d i d . L i g a t i o n o f l e f t	J u l y 28, 1903. U n t i l t h i s d a t e n o p r o p t o s i s ; p u l s a t i o n a n d t h r i l l f e l t . V = $\frac{6}{3}$ .

(45)	E. L. Pritchard.....	Oph. Soc. U. K., 1904, xxiv, p. 191.	and O S became proptosed; no pulsation, pupil dilated and vision poor. No growth felt. Under heat and iodid for approximately six weeks the proptosis nearly disappeared and vision improved. Six months later condition recurred. Subsequently pulsation and thrill over a soft swelling situated in the upper and inner part of orbit.	common carotid, April 8, 1903.	September 1, 1903; Pulsation and thrill increased, could now feel solid parts in swelling. December, 1903. Ocular condition about the same. Pulse intermittent and further operation contraindicated by general condition. Diag.:—Basal fracture. Rupture of internal carotid in cavernous sinus with injury of sixth nerve.
	O. D. F. 58. On April 6, 1901, fell down stairs and struck occiput. Seen next day when patient was comatose, pupils reacted to light; fundus normal; no hemorrhages from nose, ears, or mouth. Condition continued until April 26, 1901, when consciousness partially returned. May 7, 1901, mentality restored, complete right abducens paralysis, no congestion or proptosis. May 18, 1901, a small pulsating tumor appeared below and to inner side of O D; could be emptied by pressure. O D became proptosed, swelling increased. A systolic bruit heard over each eye also in right temple. O D disc normal, arteries normal, retinal veins dilated, tortuous, and pulsating. Subsequently throbbing in head.	Ligation of right common carotid, June 25, 1901.	After ligation pulsation and bruit disappeared. Next morning bruit again heard, pulsation under O D returned, pupil dilated. June 27, 1901, no throbbing in head; defective vision in O D; striate keratitis. November 2, 1903, fairly free from headaches. $O D = \frac{1}{2}$ + 5 $D = \frac{6}{8}$ —. $O S = \frac{5}{8}$ + 1 $D = \frac{6}{8}$ —. Tumor below to pulsate. Bruit over greater part of skull. Pupil semi-dilated and fixed. Retinal arteries and veins both dilated. No proptosis.	After ligation of carotids, no result. After venous ligation there was	
Burghard and Pritchard	Oph. Soc. U. K., 1907, xxvii, p. 184.	The above case came under Burghard's observation February 20, 1905, and then had a proptosis of O D that could be	Ligation of external and internal carotids.		

1904 (Continued).

REPORTER.	REFERENCE.	EYE, SEX, AGE, AND SYMPTOMS.	TREATMENT.	CONDITIONS FOLLOWING TREATMENT.
H. Sattler..... (46)	M ü n c h . med. Wo- chenschr., 1904, lii, S. 1176. K l i n . Monatsbl. f. Augen- heilk., 1905, xliii, S. 1.	replaced without resistance; pulsation; loud, rough systolic murmur that could be heard over the right temple and orbital region. Pulsation felt above the carotid ligature and pressure at this point controlled the bruit. Fundus normal. Ocular movements full.	March 9, 1905, right angular vein ligated.	a complete cessation of the symptoms with no recurrence except a slight temporary one. $V = \frac{4}{8}$ . Optic nerve pale.
None stated.	O S. F. 17. Ten years ago patient received a wound of the upper orbital margin. There was no pulsation of the globe, but visible and palpable pulsation over a soft round swelling above the incisura supraorbitalis. Similar swelling laterally. (Frontal and angular veins.) Along the median lower orbital margin an elongated swelling, over which no pulsation, but a thrill and blowing murmur. A very loud blowing murmur also heard over eye, but not beyond outer orbital margin. Proptosis that could be reduced by pressure. Noise in head. Compression of carotid caused swellings to become flaccid, thrill and murmur to disappear. Abducens paralysis.	Ligation and resection of frontal vein and ligation of superior ophthalmic vein after exposure of carotid.	Following operation murmur and thrill disappeared. Diag.:—Arteriovenous aneurysm of internal carotid in the cavernous sinus.	
Picqué..... (47)	A b s t r a c t Revue gén. d'Opht., 1904, p. 28. Soc. de Chir. de Paris, 1904.	—, —, —. Pulsating exophthalmos resulted from a blow on the eye from fist. Constant bruit. Vision intact. Symptoms do not disappear by compression of the two carotids.	None stated.	
(48)				



<p>W. Cheatham.....</p>	<p>Louisville Month of Jour. of Med. and Surg., 1903-04, x, pp. 425 and 439.</p>	<p>O D. M. 48. Two months before patient fell and struck right side of head. Hemorrhage from nose and ears. Then developed noise in head "like escape of steam from an exhaust valve." Exophthalmos. Bruit could be heard over any part of head, but especially over the right eye and temple. Globe nearly fixed. Had ptosis of O D for several weeks. O D blind, due to optic atrophy. Keratitis-anesthesia of cornea.</p>	<p>Ligation of right common carotid (F. Fort).</p>	<p>Following ligation the bruit ceased. When last observed, slight bruit was present. Fort believed condition due to rupture of the internal carotid in the cavernous sinus.</p>
<p>Zur Mühlen.....</p>	<p>Zeitschr. f. Ophthalm., xlv, 1904, S. 57.</p>	<p>Bilat. F. 24. Trauma of forehead at age of two years. At four years unconscious three hours, no convulsions. At ten years severe headaches and transient impairment of vision. Exophthalmos and venous stasis known to have existed for ten years. No menstruation up to seventeen years, and last time she menstruated she noted a noise in head behind right ear. When first observed had a distinct bilateral exophthalmos. Distended veins course from outer angle and disappear in border of hair; those at inner angle not so marked. Soft mass of distended veins at upper and outer portion of orbit. Thrill felt on both sides in region of origin of vena mastoidea. Over whole head, especially right, could be heard a loud systolic blow. Upon compression of right carotid murmur became less and thrill only on right side disappeared. Compression of left carotid, murmur and thrill completely disappeared. Subjective noise in right ear, hearing impaired for deep tones. Left ear normal. Ocular movements full</p>	<p>Preliminary compression followed by ligation of carotid. Local anesthesia.</p>	<p>Compression at first produced slight vertigo and paresthesia of hand and arm. Eye examination during ligation gave nothing definite. Day following ligation, O D receded and dilated veins became less marked. Palpable thrill on right occiput disappeared, while the left became less. Slight audible blow over whole head. O S receded. Throbbing in head much improved. Diag.:—Either aneurysm or rupture of the right carotid in the cavernous sinus.</p>

(49)

## 1904 (Continued).

REPORTER.	REFERENCE.	EYE, SEX, AGE, AND SYMPTOMS.	TREATMENT.	CONDITIONS FOLLOWING TREATMENT.
<p style="text-align: center;">(50)</p> <p>H. L. Barnard and H. M. Rugby.....</p>	<p>Annals of Surgery, 1904, p. 649.</p>	<p>and prompt; no Graefe or Stellwag's sign. Globe could be replaced, but returned when released. Full visual acuity. Had a left homonymous hemianopsia, complete except for about 10 degrees at fixation; hemianopic pupil reaction. Pallor of right temporal and left nasal portions of disc; retinal veins full and no pulsation; retinal arteries showed questionable contraction. Slight reduction in sensation in course of first trigeminal branch.</p>	<p>Ligation of the left common carotid; section of artery. Craniotomy—bullet removed.</p>	<p>Following ligation, no pulsation for four days, then returned and finally disappeared ten days after ligation. Pupil dilated and no light reaction; eye blind and opaque. Two months after operation, headache, temperature, right-sided convulsion involving face and arm; unconscious four hours. Craniotomy: Pus and gas at depth of <math>\frac{3}{4}</math> of an inch in the brain. Splinter of petrous bone removed. Bullet found at depth of <math>1\frac{1}{2}</math> inches, lying on top of petrous bone; removed. Died few days later with signs of cerebral compression. Autopsy: Abscess size of an</p>

Skiagraph of head showed bullet.

of cerebral compression.

orange in temporo-sphenoidal lobe. Small sacculated aneurysm of internal carotid at its first bend in the canal in the petrous bone. Oval aneurysm of internal carotid in cavernous sinus. Lateral, superior, and inferior petrosal sinuses normal. Could not find a communication between the artery and the sinus. Superior ophthalmic vein was not enlarged. Ophthalmic artery small. Optic and other orbital nerves intact.

First ligation caused a cessation of pulsation and bruit, but they soon returned. Exophthalmos and pulsation of retinal vessels less. Then internal strabismus developed and symptoms became worse. After second ligation no change in pulsation or bruit except on eleventh day they disappeared for seventeen hours. Two months after discharge exophthalmos and bruit became less. Two years and eight months after second ligation he collided with a playmate. During that day he noted a marked diminution in the bruit and exophthalmos, and on the following day the bruit disappeared and has never returned.

Ligation of right common carotid five months after the accident (C. H. Frazier).  
Bed and restricted diet.  
Ligation of left internal carotid nine and one-half months after first ligation (Frazier).

O. D. M. 15. Gunshot wound back of right ear. Vomited blood, probably due to injury of tonsil. Almost immediately complained of thumping noise behind right ear and noticed some proptosis. Three or four months later O. D. proptosed 5 mm. in front of O. S. External deviation of  $22\frac{1}{2}$  degrees. Cornea clear; pupil 3 mm. and reacted to light and accommodation. Ocular movements good except some impairment upon internal rotation. No pulsation, but a thrill upon pressure of globe, which disappeared upon carotid compression. Direct and indirect vision for form and colors normal. Scar below right mastoid, and over this could be felt a thrill more marked than orbital one. Tension normal. Fundus normal except for enlarged and pulsating veins.

N. Y. Med. Jour., 1904, lxxix, p. 691.  
Transactions of the Philadelphia Society, 1902, p. 162, Frazier.

(51)

C. A. Oliver.....

## 1904 (Continued).

REPORTER.	REFERENCE.	EYE, SEX, AGE, AND SYMPTOMS.	TREATMENT.	CONDITIONS FOLLOWING TREATMENT.
(52)				Two years and eleven months after second ligation, no exophthalmos, bruit, thrill, or pulsation. Vision, accommodation and ocular movements normal (de Schweinitz). Two months later retinal veins and arteries still slightly enlarged and tortuous.
R. Kennedy.....	Glasgow Med. Jour., 1904, lxi, p. 426.	O. D. M. 50. Struck on right side of head by a stone. Unconscious for two days; hemorrhage from both ears and nostrils, vomited blood. Right facial paralysis. In house two months. Two months after the accident developed a noise in head of a whizzing character, worse on bending or lying down, then proptosis and a beating in O. D. developed. Vision began to fail until only light perception remained. Facial paralysis began to improve six months after accident. Seven months after accident visible pulsation. Eight months after accident proptosis of O. D., pulsation of globe. Globe can be pushed back, but pulsation felt. Compression of carotid abolished pulsation. Thrill felt. Protruberance of enlarged veins at inner canthus in conjunctiva; mass of varicose veins in lids; these did not show pulsation. Loud bruit of a whizzing character, systolic in	Ligation of right common carotid eight months after accident.	Ligation followed by cessation of pulsation and bruit; proptosis less. Two days later cornea became hazy, but gradually cleared. Three and a third years after injury, slight exophthalmos of O. D.; consensual light reflex present, direct gone. Atrophy of disc, vessels but slightly reduced. V = L. P. Movements and fields normal. One or two pigment spots on cornea. Pulsation and bruit never returned.

Maynard and Rogers.

Oph. Review, 1904, xxiii, p. 86.  
Oph. Soc. U n i t e d K i n g . , 1904, xxiv.

time, heard over globe and superciliary region, but also over whole head. Audible to patient. Disappeared on carotid pressure.

O D. F. 15. Head is large and round, but not hydrocephalic. Had occasional fits. Exophthalmos of O D for past six months. Both pupils dilated and did not react. O D blind, star-shaped opacity in lens, no fundus reflex. Deep in the orbit behind the eye and to outer side a weak pulsation could be felt. Complete internal and external ophthalmoplegia. Marked optic atrophy of the left eye. Left hospital. Two and a half months later returned owing to pain and sloughing of cornea of O D.

Enucleation of O D.

Died two weeks after readmission.

First diag.:—Angioma.

Revised diag.:—Pulsating exophthalmos due to dilatation and atrophy of the optic nerve accompanying internal hydrocephalus.

Autopsy: Right optic nerve spread out into a sac containing clear fluid and passed through a greatly dilated optic foramen; orbital portion much thickened. The dilated portion was funnel-shaped and continuous by its base with the under surface of the brain, and measured one inch in its transverse diameter and one-half inch in its vertical diameter. Left optic nerve was somewhat larger than normal and contained a small quantity of fluid in its center posteriorly, while its anterior orbital portion was smaller than normal and atrophied. Lateral and third ventricle much dilated and the latter was continuous with the sac at the base of the brain. No optic chiasm could be found. Deformity of bony orbit.

1904 (Continued).

REPORTER.	REFERENCE.	EYE, SEX, AGE, AND SYMPTOMS.	TREATMENT.	CONDITIONS FOLLOWING TREATMENT.
Fruginele.....	G i o r n . i n t e r n a z . d. sc. med., N a p o l i , 1904, xxvi, 777.	O D. F. 12. Congenital asymmetry of the face and position of the eyes. O D was slightly lower and more projecting than O S. There was a distinct visible pulsation of the globe and lids. Bending forward increased the exophthalmos, while pulsation of lids became less; conjunctiva became injected. Exophthalmos could be reduced by pressure. Compression of the right carotid caused the pulsation to become less, while if both carotids were compressed there was a decrease in the amount of the exophthalmos and the pulsation almost disappeared. Compression of the right jugular vein slightly increased the exophthalmos. No murmur. Pupils and fundus normal. Ocular movements full.	Not stated.	Diag.:—Congenital pulsation of the eye.

(55\*)

1905

H. Hansell.....	Jour. Amer. Med. Assoc., 1905, xlv, 536 and 543.	O S. F. 22. Struck on inner angle of right orbit between internal canthus and nasal bone by handle of a heavy knife thrown from a distance of fifteen feet. Twenty-seven days later came under observation complaining of pain in O S and left side of head, also of a noise in the head. Following accident, hemorrhage from nose, and one day later a noise in the head, especially on the left side. Two weeks	Potassium iodid. Bed. Ligation of left common carotid twelve weeks after accident (W. W. Keen). Ligation of right common car-	As soon as ligature applied all retinal arteries became invisible. Bruit and thrill disappeared, but the former returned in twenty-four hours. Proptosis diminished. Left hospital ten days after ligation and returned one month later with recurrence of all symptoms and distinct retinal hemorrhages.
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<p>(56)</p> <p>Braunschweig.....</p>	<p>later O S became proptosed. When examined by observer, had proptosis, pulsation, bruit heard over any part of head and in neck, but loudest over the eye. Globe pushed out and down, could be replaced. Thrill, dilated veins in lids. Diplopia, movements limited, especially up and in. Severe pain. Tension normal. Left pupil 5 mm.; right, 3 mm. O S pupil reacted sluggishly to light and accommodation. Fundus normal. Systolic mitral murmur. Trace of albumin; no casts, few leukocytes and erythrocytes.</p>	<p>otid six weeks after first ligation.</p>	<p>When ligation applied at second operation, the retinal arteries disappeared as before. Three days after ligation a series of convulsions, and one day later paralysis of left side, with convulsions that became almost continuous. Died five days after last ligation. Autopsy refused.</p>	<p>O D. M. 22. Shot in right temple. Unconscious six hours. Proptosis of O D immediately after injury; heard noise in head, most marked when lying down. In hospital four months; while there developed a keratitis. Returned to hospital six months later owing to discoloration of O S. Examination showed cyanosis of upper part of face, forehead, ears, and lips; no swelling. Exophthalmos of 8 mm., could be replaced; globe pushed toward outer orbital wall. Visible and palpable pulsation increased by backward pressure of the globe. A continuous murmur with systolic accentuation heard over the right temple and side of the forehead near O D. Pulsation and murmur disappeared upon carotid pressure. Lid dependent, slight movement by frontalis, does not completely cover the globe. Upper orbital veins dilated. Paresis of third and sixth nerves. Paralysis of the fourth. Involvement of the first and second</p>	<p>Compression of right carotid, at first digital, of half-hour duration three or four times a day. Later mechanical, with gradual extension of time to two hours.</p>	<p>After couple of weeks exophthalmos less; could completely close lids; vision increased; visible pulsation, subjective and objective bruit less; abducens began to functionate. Six weeks after compression began, murmur over skull disappeared and heard only over globe near supraorbital margin. Subjectively only when both ears closed. Cyanosis practically gone. Four weeks later still further improvement. First attempts at compression associated with vertigo.</p>
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1905 (Continued).

REPORTER.	REFERENCE.	EYE, SEX, AGE, AND SYMPTOMS.	TREATMENT.	CONDITIONS FOLLOWING TREATMENT.
		<p>trigeminal branches. Paresis of facial. Remaining nerves, including optic, intact. O D can perceive numbers at <math>1\frac{1}{2}</math> m.; O S with <math>-\frac{6}{8}</math>. O D pupil moderately dilated and reacted to direct and indirect light. In both fornices symblepharon-like strands. Underpart of cornea showed a scar and patient had an ulcerating keratitis, result of nutritional disturbances or neuro-paralytic influences. Retinal veins in each eye dilated; arteries normal. Sensory and motor weakness of left arm in distal distribution of the radial and ulnar nerves. Sensation for pain diminished; tactile and temperature sense intact. Grip of left hand diminished. Internal organs normal.</p>		
<p>(57) J. L. Gibson.....</p>	<p>A u s t r a l. Med. Gaz., 1905, xxiv, p. 107.</p>	<p>O D. M. 8. Punctured wound of O D with umbrella rib, followed by pain, swelling, and vomiting. Examination showed proptosis and paralysis of the external rectus. Three months later proptosis had increased and pulsation could be felt by pressing globe backward. A loud bruit could be heard all over the skull and in the anterior triangle of the neck. Subjective bruit. Marked thrill over the jugular vein. Vision of O D = <math>-\frac{6}{2}</math>. No optic neuritis. Nine years later, while helping father to dig post-holes, suddenly exclaimed, "Oh, my head!" Died one day later.</p>	<p>Ligation of right common carotid.</p>	<p>Following ligation, bruit ceased for twelve hours, no pulsation, recession of globe. Thrill recurred next day, proptosis gradually, while there was no pulsation up to one year later. Autopsy: Evidence of extravasation under the skin in the course of the internal jugular vein. Veins of brain surface distended. Dark effused blood over the base of the brain on the right side. The right cavernous sinus was much</p>



distended and ruptured at its posterior end just in front of the apex of the petrous portion of the temporal bone. Anterior and posterior clinoid processes flattened, hypertrophied and spread out. The pituitary body was pushed over to the left.

Original diag.:—Rupture of the internal carotid in the cavernous sinus due to direct violence, with aneurysmal varix of the orbital veins.

Observer thinks umbrella rib passed through the sphenoidal fissure between the sinus and the carotid, tearing the external wall of the artery and at the same time injuring the sixth nerve.

In this case the reporter (Punzo) was the patient.

When the case was reported, the patient was gradually improving; exophthalmos and pulsation less; murmur only perceptible in the evenings.

Only a slight paralysis of the external rectus remains. Vision = 3.

Cold compresses; suture of wound and leeches immediately after the accident. **T r i o n a l** and bromids.

O D. M. —. Medical student. Was struck in the inferior and internal segment of the orbital region of the right eye with a fencing foil deprived of its ball. Was unconscious. Then had severe headache, no hemorrhages, diplopia, inward deviation of the eyes, ophthalmoplegia on the right side with more marked paralysis of the external rectus. Two days later delirium that passed off after twenty days. Jumping pulsation of the carotids. About one month after accident, cyanotic discoloration of the conjunctiva, which progressed. Turgidity of the superior palpebral veins. Exoph-

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N a p o l i ,  
1905, xx,  
129-147.

G. Punzo.....

(58)

1905 (Continued).

REPORTER.	REFERENCE.	EYE, SEX, AGE, AND SYMPTOMS.	TREATMENT.	CONDITIONS FOLLOWING TREATMENT.
(59) S. J. Taylor.....	Oph. Soc. U. K., 1905, xxv, p. 177.	thalmos, palpable pulsation. Murmur could be heard over the orbit; this detected during the delirium. Under compression of left carotid the corresponding eye still pulsated, but "the murmur was normal." Compression of the right carotid caused a cessation of the murmur and the pulsation in the two eyes. Pressing the globe in a certain direction in the orbit produced pain and an arrest of the cardiac action. Slightest movement in bed caused an acceleration of the cardiac rhythm.	Bed and potassium iodid. Ligation of the right common carotid.	After ligation bruit ceased immediately and never returned; proptosis and lid swelling gradually subsided. Five months later, proptosis gone, movements normal, pupil fixed, disc pale and atrophic, arteries and veins shrunken. Vision O D with + 5 D = $\frac{5}{18}$ (3 letters). Four years later no exophthalmos, no bruit; vision defective.
(60) F. L. Plenck.....	Wien. med. Presse,	O S. M. 32. Struck on the left side of the head with a piece of wood. Uncon-	Daily compression of left	Following compression the exophthalmos became less. When

S.  
1905,  
469.

scious one week. Hemorrhage from mouth, nose, eyes, and ears. When he regained consciousness he was blind and deaf on both sides. Vision and hearing gradually returned on the right side, but on the left the latter was completely lost and the former reduced. Then diplopia developed, and in the left temple he perceived a noise like a steam-engine. Proptosis and a mass the size of a hen's egg developed. Subjective noise and swelling were increased by stooping. At time of observation, O S proptosed forward, out and down; some ptosis; movements up and in diminished, out abolished. Globe could be replaced, but returned when pressure removed. There was a pulsating compressible tumor above the tarsus, dilated veins running to nasal and temporal sides. Visible and palpable pulsation of tumor and globe. Over the eye, also in temple and left parietal region, could hear a distinct, continuous, blowing murmur. Subjective bruit. Pulsation and murmur disappeared upon carotid pressure. O D =  $\frac{5}{5}$ . Fields for form and color normal. O S = counts fingers at 2 m. Media clear; sensation of cornea reduced (also on right side); retinal veins dilated and tortuous, no pulsation of arteries; disc edges hazy, especially to nasal side. Internal organs normal. Injury to drum-head on left side, right drum-head pale. Taste, smell, tongue, and soft palate normal. Sensation impaired over the left half of head, neck, breast to spine to two finger-breadths below angle of scapula, and upper extremity.

common car-  
otid. Further re-  
treatment re-  
fused.

patient left hospital, about three months after observation, exophthalmos distinctly less; no change in the character or intensity of the murmur. No change in fundus conditions. Vision of O S = L. P.

Diag.:—Fracture base of skull.

1905 (Continued).

REPORTER.	REFERENCE.	EYE, SEX, AGE, AND SYMPTOMS.	TREATMENT.	CONDITIONS FOLLOWING TREATMENT.
(61) Brandes.....	J a h r e s - b e r i c h t f. Oph., 1905. Orig. not avail- able.	Sensation on right side normal. Speech hesitating. Intelligence impaired. About one month later, vision O S = fingers at $\frac{1}{4}$ m.  O D. —. 81. For three weeks had a firm tumor in the orbit, could not be reduced. Pulsation and murmur disappeared upon carotid pressure.	Ligation of right common car- otid.	Following the ligation, paresis of left face, tongue deviated to same side. The day following developed a paresis of whole left side; neuro-paralytic kera- titis, complete ophthalmop- legia. Tumor disappeared. Died after ten days. Autopsy: Calcification of the carotid, with a rupture of the artery in the cavernous sinus. Atrophy of the oculomotor and optic nerve from the chiasm to its entrance into the orbit; atro- phy of the ophthalmic branch of the trigeminus and sympa- thetic. Brain softening in the region of the fossæ Sylvii. Ab- ducens not found. In the cavernous sinus a gelatinous mass. Diag.:—Rupture of the internal carotid in the cavernous sinus.
(62) M. Ballin.....	Detroit Med. J o u r . ,	O S. F. 42. Struck on the left side of the head. Not unconscious, no vomiting.	Ligation of left common carotid.	Following ligation, pulsation and bruit immediately ceased. Ex-

1905,  
p. 20.

Shortly after swelling of lids and a noise in the head that was of a pulsating character, kept patient awake at night. Then proptosis developed and vision began to fail. Veins of lids much dilated. Visible and palpable pulsation. A blowing, whistling, synchronous murmur could be heard over the whole head and side of neck. Could be heard eight inches from the affected eye. Compression of the carotid stopped murmur and caused a partial subsidence of the exophthalmos. Retinal veins pulsated. Tension slightly increased. Pupils reacted and vision reduced.

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heilk.,  
1905, xliii,  
2, 475.

G. Schwalbach.....

Direct compression of swelling and compression of left common carotid (operation refused).  
Ligation of left common carotid about three months after accident.  
Ligation and resection of the superior ophthalmic vein in the orbit.

Eight weeks after compression, exophthalmos increased, veins at outer angle dilated; retinal veins full and tortuous; murmur less marked; no thrill.  
Murmur disappeared only when both carotids compressed or when moderately deep pressure made at inner angle against the upper back wall of orbital cavity. The latter did not cause a constant disappearance of the murmur.

After ligation, murmur returned in one or two minutes, but less intense.  
Following the orbital operation the murmur disappeared; left hospital eight days later. Seven months later globe in normal position, veins in lid diminished, no headache or murmur.

(63)

(64)

1905 (Continued).

REPORTER.	REFERENCE.	EYE, SEX, AGE, AND SYMPTOMS.	TREATMENT.	CONDITIONS FOLLOWING TREATMENT.
J. Barley.....	J a h r e s - b e r i c h t f. Oph., 1905. Orig. not avail- able.	Bilat. F. 27. Spontaneous development in last half of pregnancy. Paralysis of oculomotor O S. Developed pulsation and murmur which disappeared upon com- pression of the left carotid.	Digital compres- sion and liga- tion of the left common car- otid.	After ligation O S receded while O D became proptosed and a systolic murmur developed over the eye and in the temporal region, which became weaker upon compression of the car- otid; pulsation then disap- peared. After ligation de- veloped a paresis and numb- ness of the left upper extremity. O S still showed limited motion up and down, pupil dilated and reactionless. Fundus showed dilated veins. Vision normal.
(65)				
de Bruin.....	J a h r e s - b e r i c h t f. Oph., 1905, p. 691. Orig. not avail- able.	O D. M. 16 months. Pulsating exoph- thalmos of O D. Exophthalmos of O S, but no pulsation. No preceding history of trauma, but whooping-cough.	None stated.	
(66)				
Orlandini.....	Riv. veneta, d. sc. med., 1905, xlii, 314-325.	O S. M. 51. Fell and struck forehead. Swelling and exophthalmos of O D, which became blind and gradually immovable. At the same time O S began to swell and vision became impaired. O D: non-pul- sating exophthalmos, slight pericorneal injection, cornea slightly opaque; pupil irregular, dilated and fixed. Optic papilla	Excision of pro- truding con- junctiva to re- duce stasis and diminish ex- ophthalmos.	Condition went on to spontane- ous cure. Last report, vision of O S had im- proved; no exophthalmos, no murmur; ocular movements full. "A case of bilateral exophthal- mos result of aneurysm; spon- taneous cure."

excavated, slight retinal hemorrhage, macular region showed greenish zone—probably detachment. O S; conjunctiva chemosed, pupil slightly dilated and reacted slightly. Vision =  $\frac{1}{5}$ . Retinal veins tortuous and tortuous; no pulsation. Pronounced murmur heard over the temples, ceased upon right carotid compression, not influenced by left carotid compression. Excision of protruding conjunctiva. After two or three days marked improvement. Later left eye suddenly became worse; exophthalmos increased, decrease in the mobility of the globe, a pulsating mass developed on the upper orbital margin. condition gradually improved.

O D. F. 45. Within twelve hours of the birth of a child developed pain in the head, felt something snap, and then a rushing sound in the head. Three weeks later mental condition impaired; ptosis; exophthalmos of O D; could hear a murmur over the right ear; complete anesthesia of the right side of the face. When mentally restored, complained of constant pain and rushing noise in the head. Vision impaired; loss of sensation and movements of O D; anesthesia of the right side of the forehead. Ulceration of the lower part of the cornea. No reaction of the pupil to light or accommodation. No pulsation detected. Paresis of the muscles supplied by the third and fourth nerves; complete paralysis of the sixth; impairment of the ophthalmic and superior maxillary branches of the fifth.

L a n c e t, p.  
1905, p.  
221.

Berry.....

(67\*)

Ligation of the internal carotid  $\frac{1}{2}$  inch above the bifurcation.

Following the ligation, the noise in the head and the murmur disappeared. Exophthalmos and pain became less, while the sensation of the face improved.

Diag.:—Idiopathic aneurysm of the internal carotid in the neighborhood of the cavernous sinus.

(68\*)

# 1906

REPORTER.	REFERENCE.	EYE, SEX, AGE, AND SYMPTOMS.	TREATMENT.	CONDITIONS FOLLOWING TREATMENT.
J. Evans.....	Brit. Med. Jour., 1906, 2, 1305.	O S. F. 6. Punctured wound of lower lid and orbit by an umbrella rib. After the injury had free hemorrhage from the wound and slight from the left nostril. Vomited and was dazed for a day or so. One month after the accident developed proptosis and pulsation. Veins of lid dilated and tortuous. Subjective bruit, also objective, which was of pulsating character and audible over the whole skull. Pupil contracted, but reacted to light, only slight dilatation with atropin. Iris hyperemic; optic disc had the appearance of optic neuritis; veins full and tortuous. Vision much reduced. Later developed paresis of the external rectus.	Rest in bed; potassium iodid; calcium chlorid.	Symptoms still persisted, but were improved. Vision was practically normal. Had a convergent strabismus, also subjective bruit.
(69)				
Delanglade and Pons..	Marseilles Med., 1906, p. 11.	O D. —. Attempted suicide, wound in right ear. Bullet flattened against the base of the skull at level of the neck of the condyle of the maxillary bone. O D developed exophthalmos, thrill, and bruit.	Bullet removed. Ligation of the internal carotid.	Following the operation for removal of the bullet an incomplete and transitory facial paralysis developed. After ligation the thrill and throbbing disappeared. Bruit persisted.
(70)				
Tietmeyer.....	M ü n c h . med. Wochenschr., 1907, No. 11, S. 542.	— . — . Bilateral abducens paralysis. Left-sided paralysis of the levator and tensor palati muscles, also the pharyngeal muscles. Diminution of the salivary and abolition of the lacrymal secretion on the left side. Compression of the right carotid did not abolish the murmur or the noise in the head.	Ligation of the left carotid.	Ligation without results. Diag.:—Basal fracture through the sella turcica and temporal bone, producing pulsating exophthalmos.
(71)				



<p>Gasparrini.....</p>	<p>A n n a l . d'Ocul., i 9 o 7 , cxxxvii, p. 168.</p>	<p>O D. M. 36. Spontaneous development. For one month exophthalmos, synchronous pulsation; bruit. Engorgement of retinal veins; arterial pulse. Vision = <math>\frac{5}{7}</math>.</p>	<p>Potassium iodid, 2 grams a day. Adrenalin, t. i. d. (instilla- tion).</p>	<p>Complete cure of exophthalmos in two months. Observer thinks cure should be attributed to the adrenalin, as patient had been using the iodid for twenty days without results.</p>
<p>(72)</p> <p>Cantonnet and L. Cerise.....</p>	<p>A r c h . d'Oph., 1907, xxvii, p. 34. Oph. Klimik, xi, No. 5, p. 147.</p>	<p>O S. F. 80. Condition developed abruptly with slight intraorbital pain and rapid diminution of vision; headache, vomiting, and throbbing in the head. When patient came under observation the following day had an exophthalmos; visible and palpable pulsation especially at upper and inner angle of the orbit, not modified by com- pression of the carotid. Continuous bruit without accentuation, in periorbital region; no thrill. No ear affection. Pulse slow; aortic murmur; trace of albumin.</p>	<p>No surgical in- tervention.</p>	<p>Died suddenly three weeks after development. Autopsy: Sclerosis of the coro- nary vessels of the heart; sclerosis of the circle of Willis. The internal carotid dilated at its entrance into the sinus. Rupture of the artery in the outer anterior portion of the sinus. Aneurysmal dilatation in orbit (probably arterio- venous) between the optic nerve and the superior rectus. A distended vein ran to the aneurysm from without. A diverticulum from the aneu- rysm extended vertically down- ward toward the inferior orbital fissure. The ophthalmic artery was reduced to a slender thread.</p>
<p>(73)</p>				

REPORTER.	REFERENCE.	EYE, SEX, AGE, AND SYMPTOMS.	TREATMENT.	CONDITIONS FOLLOWING TREATMENT.
H. Cushing.....	N. Y. Med. Jour., Jan. 19, 1907. The W. M. Carter lecture before N. Y. Acad. of Med., 1906.	O D. M. Young man. Squeeze of the head between beam and side of ship. Hemorrhage from ears, nose, and mouth. Several hours later became unconscious. Examination showed cyanosis of face and neck. Distended veins over median and lateral frontal regions, also veins of lids. Bilateral exophthalmos. Bruise over parietal and temporal region on right side. Right side of face moved less than left. Pupils unequal, O D pin-point, O S 4 mm.; tendency to right conjugate deviation, but globes mostly rolled about without parallelism. Two hours later, O S pupil more dilated; pulse irregular; Cheyne-Stokes breathing. Exploratory craniotomy: Revealed fracture from parietal region through base of skull involving foramen spinosum. Large clot over temporal lobe; hemorrhage from middle meningeal artery. Gauze pack used. After operation symptoms of local compression more marked; major symptoms affecting medullary centers had disappeared. Ptosis of left lid persisted. End of second day, pack removed and mental condition improved. Motor speech center and auditory centers in temporal lobe affected by long pressure; also complex speech mechanism affected. Had a total external ophthalmoplegia of O S, paralysis of abducens O D. One week after opera-	Ligation of right internal carotid (cocain).	When ligature applied retinal arteries became invisible. Bruit lost and pupil dilated immediately. After a few minutes the media became cloudy and fundus could not be seen. Patient said vision had entirely disappeared. This persisted twenty minutes, then media began to clear and small, visibly pulsating arteries came into view. With development of pulsation in retinal arteries, subjective noise in head began. Ligation caused a change in the character of the bruit; slight subsidence of exophthalmos; slight improvement in the diplopia; less distention of the vessels, but otherwise no change.

Diag.:—Arteriovenous aneurysm.

tion, auditory aphasia nearly gone; third nerve paralysis of O S much improved, leaving him with a double convergent squint. Left hospital four weeks after injury with a trace of motor aphasia and slight diplopia; otherwise well.

Not many weeks later noted a buzzing in the head and slight proptosis of O S, which subsequently disappeared. Three years later received a slight blow on the back of head. Since then noise in head and proptosis of O D, which have tended to increase; both improved by recumbent position. Globe displaced forward, out and down. Subcutaneous veins at outer and inner angle distended, supraorbital veins size of index-finger. Visible pulsation of globe and veins.

Loud continuous hum with systolic bruit heard over the whole head, best over eye. Thrill felt. Compression of carotid caused disappearance of pulsation and bruit, eye receded. Vertical and horizontal diplopia. Vision was normal; great dilatation of retinal arteries, but no pulsation.

O S. — 26. Blow on the back of the head. At the expiration of two weeks O S felt full and had slight beating in the head. Unconscious after the injury. Ocular condition and beating gradually increased for one year and at that time found O S proptosed forward, out and down. A tense tumor could be felt through upper lid. Pulsation of eye and swelling. A bruit could be heard over a space of one inch at

	<p>(74)</p> <p>F. P. Lewis.....</p> <p>Oph. Record, 1907, xvi, p. 66.</p>	<p>Incision and dissection of orbit; ligation of ophthalmic artery just within orbital cavity.</p>	<p>Three weeks following ligation, slight divergence, no bruit or exophthalmos. Three years later, both eyes perfectly normal. Slight paleness of left disc, but vision in each eye <math>\frac{20}{30}</math>. Observer regards case as interesting, because ligation within the orbit effected a cure in an</p>
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1907 (Continued).

REPORTER.	REFERENCE.	EYE, SEX, AGE, AND SYMPTOMS.	TREATMENT.	CONDITIONS FOLLOWING TREATMENT.
(75)		inner orbital angle. Pupil reacted normally, O D = $\frac{2}{3}$ ; O S = $\frac{2}{3}$ . Retinal veins full. Crossed diplopia.		aneurysm that was partly extra-orbital. Diag.:—Aneurysm of the ophthalmic artery.
G. Mackay.....	Oph. Review, xxvi, 1907, p. 213.	O D. M. 31. Thrown from a carriage on his head. Unconscious. Upon recovery felt great pain in the head, especially beneath the left parietal bone and a whistling noise in both ears. At first appeared to have a large extravasation behind globe. Pulsation of globe; unable to close lids; diplopia; vision dim. Prominence diminished, but no visual improvement. Five months later noticed dim vision in O S. Eight months after accident O D proptosed and pulsating; veins at root of nose and about right eyebrow were dilated and thickened. Bruit audible over a large area of head and neck, greatest at root of nose and about right eye. Could close lids. Paralysis of abducens. O D = fingers at 2½ m. Disc cloudy. O S = fingers at 4 m. Normal fundus except congestion of retinal veins and cloudiness of disc.	Rest; iodid and local compression.	Three months later, O D = fingers at 3½ m.; O S = $\frac{5}{6}$ . Fundus veins tortuous, disc congested. Continued to improve and returned to work. One year later (one year and nine months after accident) returned to hospital owing to proptosis and increasing distention of the external vessels. Diag.:—Traumatic arteriovenous aneurysm of the right orbit.
(76) E. E. Jack and F. H. Verhoeff.....	T r a n s . A m e r . Oph. Soc., 1907, vol.	O D. F. 53. Struck left temple against a door. Two days later exophthalmos and marked noise in the head. Upon examination (four days after injury) decided ex-	Ligation of the right common carotid five days after the	After ligation, exophthalmos diminished slightly. Difficulty in swallowing followed the operation. Next day there was

<p>xi, 2, p. 439.</p>	<p>Ophthalmos, palpable and visible pulsation; bruit heard over the lids and temple. Pulsation and bruit relieved by carotid pressure. Cornea clear, except for old scar; pupil did not react; fundus could not be seen. Twenty-four hours later, cornea began to ulcerate, condition much worse, pain excessive. Moderate cardio-vascular disease.</p>	<p>H. H. injury (H. Germain).</p>	<p>hemiplegia, probably due to ischemia; also delirium, which persisted with few normal intervals to the end. Death four weeks after the operation.</p> <p>Autopsy: Aneurysm of the right internal carotid with recent perforation into the cavernous sinus. The right optic nerve was compressed against the upper wall of the optic canal by the dilated internal carotid. Left cavernous sinus absent and replaced by a single small vein in continuity with the ophthalmic vein.</p>
<p>(77)</p>	<p>E. E. Jack.....</p>	<p>Deep incisions into the orbital tissues above and below through the lids (Dr. S. J. Mixer).</p>	<p>Incisions followed by profuse bleeding. The cornea ulcerated and eye became blind, but the other conditions gradually mended. When last observed, little or no exophthalmos and no pulsation; a cure with loss of sight.</p> <p>Reporter believes that incisions had the same effect as ligation and resection of the orbital veins, the free division of the vessels and bleeding from them leading the way to thrombosis and this extending backward.</p>
<p>(78)</p>	<p>F. Pincus.....</p>	<p>Daily compression of the car-</p>	<p>When compression was begun had weakness and convulsive move-</p>
<p>T r a n s . A m e r . Oph. Soc., 1907, vol. xi, part ii, p. 439.</p>	<p>O D. M. 54. Thrown from bicycle and struck left side of head. Unconscious twelve hours. Two days later loss of outward rotation in each eye, which disappeared at the end of a week, to be followed by an exophthalmos of the right eye, accompanied by a loud noise in the head. Examination four weeks after the injury showed exophthalmos and immobility of the right globe. Pulsation felt and heard through the upper lid. Pupil, iris, and cornea normal. Vision = fingers at 20 feet.</p>	<p>O S. M. 37. Fell and struck shoulder and right side of head. Unconscious one</p>	<p>Zeitschr. f. Augen-</p>

## 1907 (Continued).

REPORTER.	REFERENCE.	EYE, SEX, AGE, AND SYMPTOMS.	TREATMENT.	CONDITIONS FOLLOWING TREATMENT.
	<p>h e i l k ., 1907, xviii, S. 33.</p>	<p>hour. Hemorrhage from the nose, left ear, and in right orbit, followed shortly by a right facial paralysis. Twenty-four hours later when eye could be opened he noted that O D was blind. Eleven days later, complete ptosis of O D; complete paralysis of the external rectus and weakness of all the other extraocular muscles. Complete amaurosis. Pupil more contracted than O S, irregular and reacted only to indirect light. Dirty gray discoloration of the temporal half of disc; retinal arteries contracted; veins full, otherwise fundus normal. Right facial paralysis. Perforation of left drum-head with reduction of hearing. O S normal.</p> <p>Seventeen days after accident, ptosis gone, abducens unchanged, other movements normal, facial paralysis improved.</p> <p>Nine weeks after accident patient stated that within the preceding two weeks he had developed pain in the head associated with a roaring and throbbing in the head and ear. First temporary then constant proptosis, then eye became red. Examination showed O D as before, while O S was pushed forward, in and down; venous stasis; full movements of lids. Complete paralysis of the external rectus. Visible and palpable pulsation developed by backward pressure of the globe. Over the eye, temple, and</p>	<p>otid while in hospital. Irregular mechanical compression resorted to by patient after his discharge.</p>	<p>ments of the left arm, vertigo, and disturbance of speech. Compression gave some temporary relief from subjective sounds, exophthalmos and stasis phenomena became less, abducens gradually improved. Fourteen weeks after accident left hospital with instructions to continue compression. Then vision good and movements almost normal.</p> <p>Three years after discharge no change, patient at times resorted to compression.</p> <p>Six years after discharge, vision O S good, no pulsation, murmur was unchanged and increased upon the slightest exertion, when pulse also became accelerated. Still used compression at times. Patient had an enophthalmos of O D.</p> <p>Nine and a half years after accident was successfully treated for a serpiginous ulcer of O D. Still had a murmur, not influenced by left carotid pressure, but abolished when right carotid compressed.</p> <p>Ten and a half years after acci-</p>

other portions of skull could be heard a continuous roaring, interrupted by a loud systolic blow. Now and then distinct bruit de piaulement. Murmur more intense over right eye and temple. Vision, accommodation, and fields normal. Retinal veins swollen and tortuous. Compression of the left carotid had no effect upon the pulsation in the left eye, while upon compression of the right carotid the pulsation, objective and subjective murmur immediately disappeared. Subjective sounds severe and prevent sleep.

dent, O D enophthalmos; slight ptosis; no outward rotation, but movements otherwise normal. Sensation of cornea and conjunctiva diminished, scar on cornea. Right pupil more contracted than the left, irregular, only consensual reaction. Optic nerve atrophic. V = o. O S: Normal. No murmur, even in stooping. Subjective noise disappeared one week before.

Diag.:—Pulsating exophthalmos; basal fracture involving apex of orbit—right.

Gifford.....

(79)

Ophthalmology, vol. IV, 1907, p. 21.

O S. M. 24. December 2, 1901. Struck on head with a shovel. Unconscious. Six months later prominence of O S, followed in two months by a throbbing in the head. Reporter first saw patient eight months after the accident, when the globe was protruded, slight pulsation, and over the eye and left side of the head a bruit could be heard. Had enlarged veins in upper lid. V =  $\frac{2}{3}$  O.

Ligation of left external carotid (Dr. Jonas). Ligation of common carotid and a much dilated vein of the upper lid within 1 month of the first operation. Lids united to protect cornea. November 8, 1905. Incision just above the brow, dissection of the orbit and ligation of orbital vein.

No result followed first ligation. Following second operation (carotid and lid) exophthalmos more marked, pain, cornea began to ulcerate, the result of exposure. Lids united to protect cornea. Symptoms then subsided, but considerable exophthalmos and noise in the head remained. October 7, 1905. Became worse and again consulted reporter. One month later, exophthalmos marked, protrusion of a roll of edematous conjunctiva; complete ptosis. Very slight movement of the eye in any direction. Above the eye a tumor  $1\frac{1}{4}$  inches in diameter

## 1907 (Continued).

REPORTER.	REFERENCE.	EYE, SEX, AGE, AND SYMPTOMS.	TREATMENT.	CONDITIONS FOLLOWING TREATMENT.
			<p>1906. Operation for ptosis.</p>	<p>could be felt beneath the eyebrow. Over this mass a pulsation and obscure bruit. Mass was first noted about two years ago, shortly after the ligation of the common carotid. Slight pulsation in the neck above scar. Vision = fingers at 1 or 2 feet. Pupil moderately dilated; disc appeared atrophic. At time ligation about to be applied to orbital vein it broke, but no hemorrhage resulted. The mass above the eye proved to be a much enlarged vessel filled with solid blood. The pedicle where ligation broke was about <math>\frac{3}{8}</math> of an inch in diameter. No reaction followed operation. Pain, exophthalmos, and conjunctival swelling disappeared. Vision and motility improved; ptosis remained complete. May, 1906. Ptosis still nearly complete; no sign of proptosis; globe freely movable except upward. No pain. No objective, but at times a subjective bruit. Vision = <math>\frac{2}{30}</math>; disc partially atrophic.</p>



Reuchlin.....

I n a u g .  
D i s s e r t .  
T ü b i n g e n ,  
1902.

Bilat. M. 42. Fell and struck occiput; unconscious; vomited; no hemorrhages. Three days after accident O D developed exophthalmos; right abducens paralysis, paralysis of right superior, inferior, and internal rectus. Noise in head. After six weeks, bilateral ptosis and exophthalmos, greater in O D. Pulsation and palpable thrill. Over the whole skull can be heard a continuous blow with systolic accentuation; bruit de piatement; murmur somewhat more marked on right side. Corneae clear; sensation apparently reduced; right pupil slow reaction to light, prompt to accommodation and convergence. Left pupil gave prompt reactions. Compression of left carotid has no influence upon the pulsation, but compression of the right carotid inhibits it, and more on the right side.

Digital compression of right common carotid fifteen to twenty minutes.

Observer thinks the first ligation of the vein in the lid was the starting-point of the mass that subsequently developed. In this mass spontaneous thrombosis occurred which extended to branches in the orbit and to some extent into the brain, hence the alarming symptoms. Thinks the disappearance of the symptoms following the removal of the mass was probably largely mechanical.

This case reported here, owing to Schlipmann's subsequent observation on the same case. Previously reported in Reuchlin's series of cases.

1907 (Continued).

REPORTER.	REFERENCE.	EYE, SEX, AGE, AND SYMPTOMS.	TREATMENT.	CONDITIONS FOLLOWING TREATMENT.
Schlupmann.....	I n a u g. Dissert. Tübingen, 1904.		Ligation of right common carotid artery, one month after last observation by Reuchlin and fourteen weeks after the accident.	Five months after ligation, vision in each eye = $\frac{5}{5}$ — $\frac{5}{2}$ . Jäger, 1. One year and eight months after ligation, patient could do light work without difficulty. Has slight pain in the head upon great exertion. No subjective murmur for sixteen months. No exophthalmos, pulsation or murmur. Sensation of conjunctiva and cornea normal. Only has defective abduction, left more than right. O D convergent. Each eye = $\frac{5}{3}$ . Jäger, 1.

\* = Atypical or doubtful cases.

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